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A Reassurance-based Approach to Space Security

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PREFACE

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ISROP regularly commissions research to support Canadian officials by drawing on its think-tank and academic networks in Canada and abroad. The following report, "A Reassurance-based approach to Space Security", is an example of such contract research.

DFAIT wishes to acknowledge the work performed under contract by Dr. Nancy Gallagher, Center for International and Security Studies at Maryland School of Public Policy, University of Maryland.

PRÉAMBULE

Le Programme de recherche et d'information dans le domaine de la sécurité internationale (PRISI) fait partie de la Direction des relations de sécurité et de défense, qui relève elle-même de la Direction générale de la sécurité internationale. Il a pour mandat de fournir au ministère des Affaires étrangères et du Commerce international Canada (MAECI), en temps utile, des études stratégiques de haute qualité et pertinentes qui permettent d'orienter et de soutenir l'élaboration de la politique canadienne de sécurité internationale concernant l'Amérique du Nord, la coopération régionale et multilatérale en matière de sécurité et de défense, ainsi que la non-prolifération (nucléaire et non nucléaire), le contrôle des armements et le désarmement. Les thèmes de recherches actuels du Programme de recherche et d'information dans le domaine de la sécurité internationale (PRISI) figurent à l'adresse suivante: www.dfait-maeci.gc.ca/arms/isrop/menu-fr.asp

Le PRISI commande régulièrement des études pour faciliter le travail des fonctionnaires canadiens, en faisant appel à ses réseaux de spécialistes et d'universitaires au Canada et à l'étranger. Le rapport suivant, « Une approche basée sur la réassurance pour la sécurité de l'espace » est un exemple de ce type d'étude.

Le MAECI souhaite reconnaître le travail exécuté à contrat par Dr. Nancy Gallagher, Center for International and Security Studies at Maryland School of Public Policy, University of Maryland.

Executive Summary

Space security has both military and environmental dimensions that need to be addressed together through equitable rules that build on, but do not replace, the principles and obligations in the Outer Space Treaty. In both dimensions, the central problem involves a need for greater reassurance about how a growing number of state and non-state actors will use increasingly sophisticated technologies that can have both beneficial and harmful uses. On the military side, states want clearer and stronger protections for satellites being used for legitimate purposes and corresponding protections against space being used for hostile purposes. On the environmental side, states want reassurance that other space users will behave in ways that do not create more space debris or pose other unintended threats to their space activities. Both the general utility of arms control and the desirability of specific proposals look very different if the primary objective is to provide mutual reassurance, and not to stabilize deterrence or to achieve a more favorable distribution of war-fighting capabilities.

Given the dual-use nature of most space technology, the core rules needed to enhance space security are more usefully defined in terms of legitimate behavior rather than prohibited capability. A recent Canadian working paper proposes three very valuable rules, but leaves open several critical questions that cannot be answered with reference to existing international law or precedents from other arms control agreements. Therefore, this paper proposes a different type of process to strengthen existing normative protections for peaceful satellites and prohibitions on weapons in space, and to promote more constructive negotiations about additional rules and institutional arrangements to provide much needed reassurance. "Elements of a companion agreement to the OST" is provided in an annex to the paper, and sketches out potential elements of a comprehensive reassurance-based regime as a stimulus for creative thinking about how different initiatives to enhance space security could be expanded and combined into an integrated system.

Résumé

La sécurité de l'espace comporte des dimensions tant militaires qu'environnementales qui doivent être abordées ensemble par le truchement de règles équitables qui reposent sur les principes et les obligations du Traité sur l'espace extra-atmosphérique, sans toutefois les remplacer. Dans ces deux dimensions, le principal problème met en jeu la nécessité de donner des réassurances quant à la façon dont un nombre croissant d'acteurs étatiques et non étatiques se serviront de technologies toujours plus perfectionnées qui peuvent avoir des usages à la fois bénéfiques et néfastes. Sur le plan militaire, les États veulent des protections plus claires et plus fermes pour les satellites utilisés à des fins légitimes et des protections analogues contre l'utilisation de l'espace à des fins hostiles. Sur le plan environnemental, les États veulent qu'on les rassure que les autres utilisateurs de l'espace vont se comporter de façon à ne pas créer davantage de débris spatiaux ou à ne pas poser de menaces non intentionnelles à leurs activités spatiales. Tant l'utilité générale du contrôle des armements que l'opportunité de propositions spécifiques semblent très différentes si l'objectif principal est de fournir des garanties mutuelles, et non pas de stabiliser la dissuasion ou de parvenir à une répartition plus favorable des capacités de combat.

Étant donné la nature à double usage de la plupart des technologies spatiales, les règles de base nécessaires pour renforcer la sécurité de l'espace sont plus utilement définies en termes de comportement légitime plutôt que de capacités interdites. Un récent document de travail du Canada propose trois règles très utiles, mais laisse en suspens plusieurs questions cruciales auxquelles on ne peut répondre quant au droit international en vigueur ou à des précédents établis par d'autres accords de contrôle des armements. En conséquence, le présent document propose un type de processus différent pour renforcer les protections normatives existantes visant les satellites à usage pacifique et les interdictions relatives à la militarisation de l'espace, et pour favoriser des négociations plus constructives au sujet de règles supplémentaires et de dispositifs institutionnels afin de donner des réassurances indispensables. Dans les « Éléments d'un accord complémentaire au TCO » qui figurent en annexe, on décrit à grands traits les composantes potentielles d'un régime global fondé sur les réassurances qui stimulerait une réflexion constructive sur la façon dont différentes initiatives pour renforcer la sécurité de l'espace pourraient être élargies et combinées en un système intégré.

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Full Report

Introduction

Space is a uniquely valuable environment in which to conduct activities of growing importance to the global economy, to information-based security strategies, to environmental protection, and to other aspects of modern life. But space is also a technologically challenging and expensive environment where satellites are vulnerable to natural hazards, to inadvertent harm caused by other space users' activities, and potentially also to deliberate interference for strategic or tactical military advantage. Most of the same capabilities needed to access and use space for constructive purposes could also be used in hostile or irresponsible ways, often with less technological sophistication and expense. Even before the first satellites were launched, this combination of value, vulnerability, and dual-use potential made it clear that international cooperation would be a pre-requisite for space security—i.e., secure, safe, and sustainable access to, and use of, space for peaceful purposes, coupled with the freedom from space-based threats.

The United States initially led international efforts to develop formal and informal rules to protect legitimate uses of space, to prevent the widespread deployment or first use of space weapons, and to promote cooperation in the safe, sustainable use of space for mutual benefit. One result of its efforts, the 1967 Outer Space Treaty (OST), remains the foundational document of a rule-based approach to space security. The OST's general principles sought to balance diverse interests by ensuring that all states use space for peaceful purposes, respect international law, and avoid causing harmful interference to other space users.

Ensuring space security has grown more complex over time. An increasing number of countries can operate independently in space, and an even larger number have a direct stake in space security. A commercial space industry has developed distinct from government-run civilian or military programs. Moreover, technological advances have raised new questions about which military uses of space are "in accordance with international law" and "in the interests of maintaining international peace and security" and which are intolerably threatening or aggressive.

As these challenges have intensified, the world's capacity to manage them cooperatively has declined. Instead of continuing to lead international efforts to work out rules protecting and enhancing everybody's ability to use space for peaceful purposes, the United States became increasingly interested in its own flexibility of action in space.[1] Indeed, the George W. Bush administration explicitly rejected the possibility that any new international legal constraints on U.S. military uses of space could enhance its national

[1] Both approaches are sometimes referred to as preserving U.S. freedom to access and use space, but the former seeks this freedom through consensual rules protecting legitimate activities from deliberate or inadvertent interference, while the latter rejects rules and relies instead on unilateral power.

security and embraced the objective of maximizing U.S. military space dominance for unilateral strategic advantage.[2]

Today, post-Cold War optimism about increased international cooperation on commercial and civilian uses of space has been dampened and displaced by the prevailing concern that a potential enemy might be able to use space in hostile ways. This concern has caused a number of countries to increase their space-related military capabilities and to undertake actions that others find potentially threatening. In turn, the United States has used some of these actions, such as China's 2007 test of an anti-satellite (ASAT) weapon, as evidence of near-term threats that require a redoubled effort to acquire full-spectrum space dominance, which other countries predictably resist. Diplomatic efforts to control this dangerous dynamic through traditional Prevention of an Arms Race in Outer Space (PAROS)-style negotiations have stalled, and attempts to enact voluntary codes of conduct have had marginal results.

The situation has deteriorated to the point where urgent action is needed to advance three basic, inter-related goals for space security. Since no country has ever used space-based weapons against terrestrial targets or ballistic missiles, nor physically attacked another country's satellite, it is vitally important to preserve these valuable thresholds as the capabilities and short-term incentives for attacking space assets increase. A secondary objective is to prevent a reoccurrence of ASAT tests or other actions that cause disproportionate damage to the space environment, increasing long-lasting space debris and raising other inadvertent risks for fellow space users. A third objective underscored by the February 2009 collision between an Iridium satellite and a defunct Russian satellite is to better coordinate operations and combine resources for a safer, more sustainable expansion of state and non-state space activities.

New political leadership in Washington has opened a window of opportunity for diplomatic initiatives to enhance both the military and the environmental dimensions of space security. As a candidate, Barack Obama pledged to take a more cooperative approach to protecting space assets from disruption, preventing the weaponization of space, minimizing space debris, and enhancing space situational awareness.[3] His administration is conducting a space policy review in hopes of releasing a revised National Space Policy by mid-2010.[4] Yet, many of the review's major players are either holdovers from the Bush

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[2] For an unclassified summary of the Bush administration's National Space Policy, released October 6, 2006, see http://www.ostp.gov/galleries/default-file/Unclassified%20National%20Space%20Policy%20--%20FINAL.pdf. For a skeptical assessment of US efforts to achieve military space dominance, see Nancy Gallagher and John D. Steinbruner, *Reconsidering the Rules for Space Security*, American Academy of Arts and Sciences Occasional Paper (2008), at: http://www.amacad.org/publications/reconsidering.aspx.

[3] "Advancing the Frontiers of Space Exploration," August 2008 position paper at BarackObama.com. Shortly after President Obama took office, new policy guidelines on the White House website included language intended to summarize his campaign positions, including a commitment to seek a ban on weapons that "interfere with military and commercial satellites."

[4] The initial space policy review is due October 1, 2009 and a Congressionally mandated Space Posture Review is due to Congress by December 1, 2009. See Amy Klamper, "President Orders Sweeping U.S. Space Policy Review," *Space News* (July 2, 2009).

administration or new appointees who are more focused on other policy issues, so the U.S. government will likely need external encouragement and support to turn campaign promises into policy achievements. While it is too early to know what initiatives the Obama administration might support and what kinds of military space activities it might be willing to foreclose if others did likewise, it is not too early to initiate comprehensive international discussions intended to get the United States, China, Russia and others to think seriously about these questions.

Of the countries that have been active on space security, Canada is best positioned to promote a new diplomatic strategy that uses the complexities of space security as a motivation for innovative forms of cooperation rather than for unilateral action. Canada is sympathetic to, but not exclusively focused on, the central concerns advanced by the other major players—the Russian and Chinese desire to prohibit space weapons, the European Union's emphasis on protecting the space environment, and the U.S. interest in freedom to use space for legitimate military purposes. As part of its diplomatic identity, Canada has already assumed a leadership role on space security while other Middle Powers like Australia and Japan have devoted more of their diplomatic energy to nuclear issues. Canada has also been a successful cooperative security policy entrepreneur before, advancing the concept of "human security" and pioneering the Ottawa process that produced the landmines ban.

This paper seeks to stimulate thinking and international discussion about the elements of an advanced cooperative security regime for space and about a pragmatic process for its development. It begins by briefly explaining why the political changes in Washington do not mean that the time is ripe for agreement on a PAROS-style arms control treaty or a voluntary code of conduct to protect the space environment, let alone a stand-alone ban on kinetic energy anti-satellite weapons (KE ASATs) as some U.S. security analysts have proposed. The second section expands on the central insight of a recent Canadian working paper that the dual-use dilemmas created by the global spread of satellite, missile, and missile defense technologies are best addressed through an equitable package of behavioral rules that cover both the military and the environmental sides of space security.[5] Accomplishing this, though, requires close attention not only to desirable new rules, but also to the principles behind the rules, the purpose they are intended to serve, and the process through which they could be developed and applied.

The third and fourth sections of this paper propose a different way of thinking about the principles, purpose, and process for space security. Framing the central principle of a space security regime as reassurance, not deterrence or war-fighting, would address the core concerns of key players in a way that underscores the need for new forms of cooperation and makes them easier to achieve.[6] Establishing from the outset a mechanism through which all stakeholders can have their concerns heard and their interests weighed would build the confidence and transparency needed for increasingly consequential forms of cooperation.

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[5] "On the Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security," Canadian Working Paper, tabled at the Conference on Disarmament on March 26, 2009.

[6] Reassurance and deterrence strategies both seek to influence others' choices by altering their incentives, but deterrence relies primarily on threats to discourage undesirable behavior while reassurance relies more heavily on positive moves to encourage desirable behavior. Reassurance can involve unilateral steps, informal reciprocal restraint, or formal agreements.

The final section sketches out the basic elements of a reassurance-based cooperative security regime for space to illustrate how a fully developed system could address many of the most vexing challenges of space security in a way that looks very different from traditional arms control but that is much better suited to the special characteristics of space.

Military and Environmental Dimensions of Space Security

Ever since the United States stopped leading international efforts to supplement the OST, other countries and non-governmental organizations have tried to fill the void. Proposals for multilateral PAROS-style negotiations date back to the mid-1980s after the Reagan administration rejected the kind of stand-alone ASAT ban that the Carter administration sought with the Soviet Union and instead made space the centerpiece of its Strategic Defense Initiative. The EU's draft Code of Conduct for Outer Space Activities grows out of efforts that started in the mid-1990s to identify best practices and coordinating mechanisms that an increasing number of actors using space primarily for non-military purposes could follow to minimize inadvertent interference and environmental damage.[7] Much diplomatic and intellectual capital has been invested in these two approaches to space security, so it is understandable that their proponents might want to press forward with renewed vigor under changed political circumstances. There are good ideas in both approaches, but each speaks to the major security concerns of the originating countries without paying adequate attention to the security concerns of the other major space-faring nations. Moreover, each reflects a particular way of thinking about space security that made sense when the strategy was originally developed, but fails to capture the most important features of space security now and in the future.

The most fully developed idea that has been advanced in the context of PAROS discussions in the Conference on Disarmament (CD) is the Russian- and Chinese-proposed draft "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Space Objects" (the PPW Treaty). The PPW Treaty has the hallmarks of classical arms control intended to enhance strategic stability[8] and, as the title makes clear, the accord would extend the OST's ban on orbiting weapons of mass destruction in space to a more general prohibition on deploying any type of weapon in space. The PPW Treaty would also transform the OST's vague protections for satellites into an explicit behavioral rule prohibiting the threat or use of force against space objects, defined to include any type of hostile action that interferes with a space object's normal functioning. The draft PPW Treaty encourages states to practice voluntary confidence-building measures, and suggests that any mandatory verification obligations could be addressed in an additional protocol.[9]

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[7] Council of the European Union, "Council conclusions and draft Code of Conduct for outer space activities," Brussels, 3 December 2008, 16560/08, http://register.consilium.europa.eu/pdf/en/08/st17/st17175.en08.pdf.

[8] "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Space Objects," draft of February 12, 2008, at: http://www.mfa.gov.cn/eng/wjb/zzjg/jks/kjfywj/t408357.htm.

[9] In an earlier non-paper, the Chinese and Russian delegations argued the OST and many other treaties had enhanced security without including elaborate verification provisions. Therefore, states should concentrate on reaching consensus about new legally binding rules to prevent the weaponization of space, and consider later whether the added benefits of formal verification could be achieved in a way that was politically acceptable,

Russia and China see the prospect of weapons in space and attacks on satellites as highly destabilizing for many reasons. They have been especially interested in preventing the United States from deploying space-based missile defense interceptors that would increase unpredictability and that could, in theory, neutralize their nuclear deterrents. Furthermore, conventional weapons in space would be more likely than nuclear weapons to be used for short-notice strikes anywhere on the globe or for clandestine attacks on satellites. They would generate suspicions, raise tensions, and be tempting targets if an attack looked likely or war was already underway. An arms race or asymmetrical competition for military advantage in space would hurt the prospects for civilian and commercial cooperation there.[10]

Proponents of U.S. missile defense and U.S. military superiority in space have responded to the PPW proposal in a familiar way, objecting to the lack of definitions, verification, and enforcement—the same arguments they have been using to head off serious discussion of space arms control since the late 1970s.[11] The dual-use nature of much space technology does make it hard to distinguish between those space capabilities that are threatening and those that are benign, especially without highly refined mechanisms for sharing compliance information and managing compliance concerns. This ambiguity, though, poses a greater problem for unilateral space security strategies than it does for cooperative ones, so it is not a reason to assume that negotiations would be pointless.

States and nongovernmental groups whose primary concern is protecting the space environment have also objected that PPW proposal does not explicitly ban the testing or possession of debris-generating ASAT weapons based in any environment besides space. But unless the United States is willing to ban the testing or possession of any type of missile defense interceptor that could be used as a hit-to-kill ASAT (as demonstrated by the deliberate destruction of the defunct USA-193 satellite), the PPW approach of prohibiting objectionable behavior in the context of an overall space security regime designed to minimize incentives for any type of ASAT use is a more likely basis for agreement than banning only one category of ASAT capability (dedicated, debris-generating ones) would be.[12]

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technically feasible, and financially affordable. See "Verification Aspects of PAROS," August 26, 2004, at http://www.china-un.ch/eng/cjjk/cjjblc/t199364.htm.

[10] Statement by Sergey Lavrov at the Conference on Disarmament, Geneva, February 12, 2008, p. 5 at: http://www.un.int/russia/new/MainRoot/docs/off_news/120208/newen1.htm.

[11] "Letter dated 19 August 2008 from the Permanent Representative of the United States of America," CD/1847 (21 August 2008). This letter objected to the PPW proposal on numerous grounds, especially its delineation between prohibited and permitted activities, its lack of any legally binding verification provisions, and its proposal for an Executive Organization that would have broad but unspecified powers to "put an end to the violation." The letter incorrectly asserted that it has been consistent US policy for thirty years to oppose all new arms control concepts, proposals, or regimes that would restrict military or intelligence uses of space or constrain US research, development, testing, or operations in space. It also implied that international discussions to revise the PPW draft would be pointless because a ban on weapons in space or terrestrially based ASAT weapons could not be verified.

[12] In February 2008, the United States used a modified sea-based theater missile defense interceptor to destroy a malfunctioning satellite before it fell to earth, claiming that the hydrazine fuel tank might pose a public safety hazard if it fell towards earth intact and released a noxious gas on impact. The United States argued that this use of a kinetic anti-satellite capability was fundamentally different from the Chinese test the previous year

Those countries who are primarily concerned about the space environment are less worried than Russia and China about how the United States might use its superior military space capabilities for strategic or tactical advantage. Instead, they are more concerned about how "irresponsible" space-faring nations might act in ways that would degrade the space environment for those not engaged in a competition for military advantage there. The EU's voluntary code of conduct hopes to build on the less controversial aspects of space cooperation, existing principles and best practices, but leaves the application of general principles to specific situations for individual states to decide. The code couches the most important new behavioral guidelines in environmentally friendly terms: avoid those actions that generate long-lasting space debris and those that otherwise damage or destroy space objects unless done to reduce space debris or address imperative safety considerations.

Such voluntary efforts to raise the standards for responsible space behavior might have seemed adequate in the 1990s, when most observers expected that the changing demographics of space users would steadily decrease strategic conflicts and increase incentives for cooperation on commercial, scientific, and human security applications. The United States' recent efforts to achieve comprehensive space dominance, though, have changed the context such that China, Russia, and any number of other countries will not foreswear the ability to target satellites without legally binding reassurances about how the United States will develop and use its superior military space capabilities. Nor will they provide significantly greater transparency about their own space programs and plans unless they have much greater confidence that the information will not be used against them.

Some experts close to the Obama administration have recently proposed reconsidering whether additional legal agreements could help protect U.S. interests in space. In effect, they want to drop the principle added to the 2006 National Space Policy that directs the United States to categorically oppose all new legal regimes or other restrictions on U.S. access to or use of space, and return to the more open-minded position in all previous U.S. National Space Policies.[13] Like the Russians and Chinese, these U.S. experts argue that additional space arms control could enhance strategic stability. But instead of involving comprehensive prohibitions on weapons in space and on threats or use of force against space assets, these U.S. proposals involve only modest forms of cooperation and maintain a largely adversarial approach to space security. For example, Bruce MacDonald, a former Clinton administration official, has proposed that the United States should make deterrence, not military dominance, the primary principle guiding its space security policy and should consider whether the costs and risks associated with space deterrence could be reduced

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because it had a public safety rather than a security rational, was conducted at a sufficiently low altitude so as not to generate long-lasting space debris, and was handled in a more transparent manner. Independent analysts have estimated, though, that the probability of even one person being killed by the fumes was extraordinarily small, and there is no public evidence that the Bush administration placed any weight on the negative diplomatic and strategic consequences of demonstrating that a missile defense interceptor could be rapidly adapted for anti-satellite use.

[13] The 1996 National Space Policy specifies that the United States will conclude agreements governing activities in space that are "equitable, effectively verifiable, and enhance the security of the United States and our allies." Even the Reagan administration's 1982 National Space Policy said that the United States will consider specific arms control measures that were verifiable, equitable, and compatible with U.S. security but oppose general prohibitions on military or intelligence uses of space.

through accords banning debris-generating tests, regulating peacetime laser use, or restricting how close one country's spacecraft could come to another country's military satellites.[14] Other U.S. experts whose primary interest is nuclear weapons policy have also adopted the idea of a trilateral kinetic energy (KE) ASAT ban.[15]

A stand-alone ban or normative prohibition on KE ASAT activities might seem like the most obvious area of overlap among traditional proposals for space arms control, emerging concerns about the space environment, and U.S. military preferences for temporary and reversible ASAT options over permanent and debris-generating ones. But a stand-alone KE ASAT proposal is too limited and lopsided to be a fair test of interest in cooperative space security. Moreover, if—as in the EU Code of Conduct—the rule included an exception for KE ASAT activities conducted in such a way as to reduce net space debris or to satisfy imperative safety concerns, but did not include an independent process to weigh competing claims about the positive safety or environmental benefits against the negative effects on space security, then the proposal would seem unfairly biased against the type of KE ASAT test that China conducted in 2007 and in favor of the kind that the United States conducted in 2008.

Without tighter legal constraints or other reassurances that satellites will not be used in intolerably threatening ways, key countries are unlikely to give up the right to damage or destroy them should national security imperatives override environmental considerations. This is especially true if one assumes that the United States has more non-debris-generating anti-satellite options than do other countries because of the relative magnitude of its military space programs and its preference for temporary, reversible, and environmentally friendly ASAT options. Nor would a stand-alone ban necessarily be a good stepping stone to broader cooperative space security. In the unlikely event that China and Russia agree to the space equivalent of the Limited Test Ban Treaty—e.g., an accord that addresses environmental concerns and constrains only the subset of activities most clearly in U.S. interests—it would decrease U.S. incentives to negotiate further restrictions on those military uses of space where it retains a significant interest and advantage.

Building on the Canadian Synthesis

The Canadian working paper, "On the Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security," is a creative attempt to synthesize ideas from these existing space security proposals into a compromise that could appeal to all the major players. The paper calls on the international community to address issues left unresolved in the OST by adopting a balanced package of security and safety guarantees as voluntary principles (soft law) that could evolve into formal treaty commitments (hard law) over time. It proposes that the CD negotiate a set of behavioral principles that would essentially rule out physical combat in space (e.g., the most destructive

[14] Bruce MacDonald, "China, Space Weapons, and US Security," CFR No. 38 (September 2008), http://www.cfr.org/publication/16707/.

[15] "US Nuclear Weapons Policy," CFR Independent Task Force Report No. 62, (April 2009), at: http://www.cfr.org/publication/19226/.

or debris-generating activities) while allowing some forms of temporary, reversible, and localized interference (e.g., electro-optical sensor dazzling or radio-frequency jamming) when it would be consistent with U.N. Charter rules for the use of force and other international law. Meanwhile, the U.N. Committee on the Peaceful Uses of Space (COPUOS) would do parallel work on best practices and coordinating mechanisms so that the number and diversity of space activities could continue to increase without a corresponding rise in inadvertent dangers (e.g., space traffic accidents or safety hazards posed by satellites falling to earth). Implicit in the Canadian paper is the need to develop refined rules to determine when activities that do not damage or destroy satellites constitute irresponsible behavior or improper interference with the right to use space for peaceful purposes, and when they would be legitimate for self-defense or other compelling reasons.

As the Canadian paper notes, the OST was the best space security agreement that could have been negotiated in the 1960s, given the adversarial nature of the superpower relationship, the early stage of space technology, and the embryonic state of arms control.[16] The OST established that all states were free to use space "on a basis of equality…in accordance with international law…and in the interests of maintaining international peace and security." It foreclosed a few undesirable avenues for competition (orbiting weapons of mass destruction and conducting military activities on celestial bodies) and tacitly legitimated satellite reconnaissance. It also urged states to consider other space users' interests and to consult about any activities that might cause harmful interference. The central idea behind the OST—that the best way to protect vulnerable satellites was to connect rights to responsibilities and restraints on terms that applied equally to all space-faring countries—remains as valid today as when the treaty was negotiated.

Much has changed, though, since the early years of the space age when the principles and policy declarations that formed a basis for the OST were developed.[17] The Canadian paper focuses on the technological advances that could lead to more widespread ASAT capabilities, particularly the growing number of countries that have, or could soon develop, ballistic missiles, hit-to-kill missile defense interceptors, and small maneuverable satellites. Depending on their level of technological sophistication, numerous countries and even some non-state actors have many ways they could—in theory at least—interfere with the normal functioning of satellites.[18]

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[16] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 601 U.N.T.S. 206 (1967).

[17] The United States made a concerted effort to establish the peaceful nature of its space program and the legitimacy of reconnaissance satellites, including a series of choices that led to the Soviet Union becoming the first country to launch a satellite. The two broadest security principles in the OST – that international law applies to outer space and that outer space is free for all states to use in conformity with international law – were first adopted by the UNGA in 1961, then elaborated by COPUOS into the declaration of legal principles adopted by the UNGA in December 1963. One of the OST's two specific prohibitions on military uses of space, its ban on weapons of mass destruction in orbit or on celestial bodies, began as parallel unilateral declarations of restraint made by the superpowers and endorsed by the UNGA in October 1963.

[18] Options for interfering with satellites are evaluated in much more detail in David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security,* American Academy of Arts and Sciences Occasional Paper (2005), pp. 125-128, at http://www.amacad.org/publications/Physics_of_Space_Security.pdf.

At one end of the spectrum are relatively simple and inexpensive options, such as attacks on ground stations or jamming signals sent from satellites to receivers on Earth. Mid-range means of interference include: using low-powered lasers to "dazzle" an imaging satellite's optical sensors; launching a medium-range ballistic missile at a satellite, putting debris in its vicinity; or creating an intense electromagnetic pulse that generates high levels of persistent radiation. High-end options available only to advanced space-faring nations and sometimes only in the research stage, include using high-powered ground-based lasers with adaptive optics or space-based high-powered microwaves to disrupt, damage, or destroy a satellite without creating space debris.

The more countries depend on satellites for military, economic, and political ends, the more tempting it may be for potential adversaries to interfere with these satellites, particularly when doing so could let a much weaker player exploit its adversary's vulnerabilities or enable a much stronger player to preserve its overwhelming tactical military advantages. Of course, there are technical constraints and practical complications associated with each potential form of interference, and nations can adopt countermeasures if the risk to their assets outweighs the added expense. Furthermore, the same trends that have increased capabilities and incentives to interfere with space assets have also increased disincentives. These include the higher probability of retaliatory attacks; the greater likelihood that satellites other than the intended target would become collateral damage; and the potentially massive, unpredictable, and uncontrollable economic consequences if global financial markets were to get spooked by hostile action in space between economically entwined countries.[19] As capabilities and incentives for interference with space assets increase, though, clearer rules and stronger mutual restraints are needed to reinforce these disincentives. This is especially the case with respect to actions that would not necessarily violate the OST, but that would reduce space security or damage the space environment.

The OST needs to be supplemented with more explicit rules protecting peaceful satellites and regulating potentially dangerous space activities for two other, equally important reasons. One involves changes in the security context since 1967, especially in the principles guiding U.S. security policy, that compound the technological reasons why it has become increasingly difficult to differentiate between "passive" military support activities traditionally accepted as "peaceful" (denoting "non-aggressive") and more "active" support for on-going military operations that might not be consistent with international law. The other rationale reflects the OST's inadequate process for members to make joint decisions about contentions questions, verify compliance, and manage compliance concerns–concerns shared with other early arms control accords.

When the OST was negotiated, the only two governments with major space programs were adversaries whose relationship revolved around mutual deterrence. Early U.S.

[19] Some people believe that the primary reason why the United States and the Soviet Union never attacked each other's satellites during the Cold War was because they feared that doing so would lead to nuclear war, and that the diminished likelihood of large-scale nuclear war now means that countries will be less hesitant to interfere with each other's satellites if doing so could provide some tactical military advantage. This underestimates the residual risk that interference with space assets in the context of a crisis or a conventional conflict could escalate into nuclear war. It also ignores the fact that the United States and China are highly economically interdependent and both countries' overall economic performance also depends on confidence in global financial markets that are beyond either government's control.

space diplomacy had two principle objectives: (1) to enhance terrestrial deterrence by legitimating stabilizing space activities and prohibiting highly destabilizing ones; and (2) to provide reassurance about the peaceful, mutually beneficial nature of U.S. space programs as the superpowers competed for favorable world opinion. In the arms control logic of the time, mutual deterrence stability required that both superpowers have nuclear forces capable of surviving an attack and inflicting unacceptable retaliatory damage, not ones that were better suited for launching a surprise attack, were highly vulnerable and subject to use-them-or-lose-them incentives, or were prone to uncontrolled escalation.

Early U.S. efforts to protect satellites through the OST and additional legal prohibitions on interference with satellites used for arms control verification, tacit reciprocal ASAT restraint, and the like, were premised on the belief that it was mutually beneficial for both superpowers to have reliable space-based information and communication satellites. They made arms races, false alarms, uncontrolled escalation, and other forms of inadvertent deterrence failure less likely. Other countries accepted the superpowers' reassurance that using space for reconnaissance, early warning, arms control verification, and crisis communications was acceptable under the OST because these functions reduced the likelihood of nuclear war.

In the 1980s, the Reagan administration began to change the context for military uses of space by embracing a more unilateral conception of deterrence, one in which the United States needed both unmistakable military superiority and a demonstrated willingness to fight and win a nuclear war in order to deter Soviet aggression.[20] Instead of believing that both superpowers would benefit from rules and tacit restraints to protect satellites and prevent the deployment of weapons in space, the Reagan administration accelerated U.S. ASAT development so that it would have more advanced means to destroy Soviet military-support satellites. It also announced a new initiative to develop space-based missile defense. The end of the Cold War and the dissolution of the Soviet Union took away the primary strategic justification for these programs, but neither the administrations of George H. W. Bush nor Bill Clinton achieved consensus on a strategic principle other than deterrence to guide post-Cold War security and space policy.

Through its policy pronouncements, military planning documents, and acquisition programs, the George W. Bush administration went even further than Reagan and openly advocated using space for national war fighting advantage rather than deterrence stability. It changed the central principle for U.S. security policy from deterrence to coercive prevention by declaring a willingness to use force, unilaterally if necessary, to prevent hostile states or terrorist groups from acquiring the materials and technologies needed to make weapons of mass destruction.[21] The Bush administration continued to define all U.S. military space programs as peaceful and legal under the OST's reference to the U.N. Charter's rules for the

[20] Whereas the arms control logic that undergirded the SALT/ABM agreements assumed that deterrence could fail if either superpower had so much first-strike capability that the other side could not be confident about its retaliatory capability, the logic that dominated Reagan-era security policy assumed that the only strategic effect of U.S. military superiority would be to strengthen deterrence of deliberate Soviet aggression, without considering the potentially increased likelihood for inadvertent deterrence failure or deliberate US attack.

[21] George W. Bush, "The National Security Strategy of the United States of America," September 2002.

use of force. Most other countries, though, would reject the broad claim that using satellites to support or conduct preventive military action would be legal without Security Council authorization.[22] Some have gone even further and asserted that advanced U.S. space capabilities aimed at perpetuating the nation's position as the world's sole military superpower are "counter to the fundamental principle of peaceful use of outer space," regardless of the circumstances under which those war fighting capabilities might be used.[23]

Reaching agreement on the appropriate balance between reassurance, deterrence, and coercive prevention should be the first step towards developing basic principles to guide post-Cold War space and security policy. These agreed principles would in turn make it much easier for states to agree about which uses of space are peaceful and show due regard to the interests of other OST States Parties, and which are aggressive, intolerably threatening, or unacceptably reckless. The former would be deserving of legal protection (e.g. a right of safe passage), and the latter should be stopped through tighter regulations or, in the extreme, legitimate self-defense.

Current thinking about the guiding principles for space and security policy is best characterized as a poorly specified mix of deterrence and reassurance. Although the Obama administration has not yet formally adopted a new U.S. National Security Strategy, the Bush administration's second-term behavior did suggest a greater appreciation for the inherent difficulties of coercive prevention, not least of which is legitimating such actions in any but the most extreme situations. Meanwhile, the Russian and Chinese approaches to space security still seek to stabilize deterrence, but in a post-Cold War context in which the United States has vastly superior conventional capabilities and is vigorously trying to deploy missile defenses. The more that deterrence characterizes relationships among major powers, the more important it will be to continue protecting stabilizing uses of space for early warning, arms control verification, crisis communications, and escalation control.

The European Code of Conduct seeks primarily voluntary reassurance that the space environment can be managed sustainably as the number of space users and importance of space activities increases over time. The United States has clearly indicated that it wants reassurance from other countries, both that emerging space powers will be "responsible stakeholders" and that potential adversaries will not use space for asymmetrical attacks. It remains to be seen, though, how far the Obama administration will be willing to go in order to provide other countries with reciprocal reassurance about how it intends to act as the world's dominant space power.

Another major weakness of the OST that needs to be supplemented is the lack of formal multilateral decision-making and compliance management mechanisms. The less clear-cut a treaty's rules are, the more important it is to have some built-in way for parties to discuss, and reach agreement about, how to apply broad, ambiguous, or conflicting rules to specific cases. Moreover, the greater the likelihood of compliance disputes, either because a treaty's rules do not lend themselves to decisive monitoring by national technical means

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[22] Michael Byers, *War Law,* (NY: Grove Press, 2005), esp. pp. 79-81.

[23] Statement by H.E. Mr. Li Changhe, Chinese Ambassador for Disarmament Affairs, Conference on Disarmament, March 12, 1998, http://www.nti.org/db/china/engdocs/lich0398.htm.

(NTM) or because noncompliance can easily occur for reasons other than deliberate cheating, the more important it is for the treaty to include cooperative means for assessing compliance and addressing compliance concerns.[24]

The OST has even less in these regards than the 1957 Antarctic Treaty, the one earlier multilateral Cold War non-armament agreement. Under the OST, members agree to provide information about the nature, conduct, locations, and results of their space activities "to the greatest extent feasible and practicable" (Article XI); they can "on a basis of reciprocity" observe other members' activities on celestial bodies (Article XII); and they are obliged to consult before carrying out activities that might interfere with other members' use of space and have the right to request a consultation if they are concerned about potentially harmful interference from somebody else's space activities (Article IX). In principle, OST members could use these provisions to interpret the peaceful use requirement as already outlawing any type of orbiting strike weapon, but this would require a special diplomatic or legal initiative, because the treaty has no built-in review process or other routine mechanism for aggregating members' concerns.[25] In practice, even the treaty's minimalist transparency and consultation mechanisms have rarely been used.[26]

As a package, the three new rules proposed by the Canadian working paper would address the most important concerns raised by the Chinese and Russians, the Europeans, and the United States. It would also cover both dedicated space weapons and dual-use capabilities employed as weapons. Because physical combat in and from space would cross an important threshold for space security and would likely permanently damage the space environment, the Canadian proposal concentrates on three central prohibitions against:

1) placing in orbit around the Earth any weapon or any objects carrying weapons, or stationing weapons in outer space in any other manner;

2) testing or using anything as a weapon against any satellite so as to damage or destroy it; and

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[24] Abram Chayes and Antonia Handler Chayes, *The New Sovereignty*: *Compliance with International Regulatory Agreements* (Cambridge, MA: Harvard University Press, 1995).

[25] George Bunn and John B. Rhinelander, "Outer Space Treaty May Ban Strike Weapons," Letter to the Editor, *Arms Control Today* (June 2002). Concerns about compliance with the OST have been raised in political fora such as the U.N. General Assembly and COPUOS.

[26] The United States monitored the two flight tests that China conducted before its January 2007 ASAT intercept, but expressed no concerns, which may have led Chinese leadership to assume that the United States would not object after the intercept occurred, either. The United States did not issue a demarche immediately, but waited for more than a week until leaked news of the ASAT test appeared in *Aviation Week and Space Technology*. The United States criticized China for creating large amounts of long-lasting space debris, for its secrecy before the test, and for its failure to provide a full explanation afterwards, but did not claim that the ASAT test was, by definition, a violation of the OST. A number of other countries, including Canada, Russia, the EU, and India, expressed concern about the Chinese ASAT test, but only Japan formally declared it to be inconsistent with "basic international rules such as the Outer Space Treaty." See Gregory Kulacki and Jeffrey G. Lewis, "Understanding China's Antisatellite Test," *The Nonproliferation Review* 15:2 (July 2008) and David A. Koplow, "ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons," *Michigan Journal of International Law* (forthcoming).

3) testing or using a satellite itself to inflict damage or destruction on any other object by direct action.

The Canadian paper leaves open several important, difficult questions:

1) When would it be acceptable for states to engage in non-physical means of interference with another country's use of space? In other words, where is the line between those military uses of space that are "peaceful" and thus completely protected, and those that are not, in cases that do not fit classical conceptions of transborder aggression or deterrence stability?

2) In the event that a country uses space for aggressive, illegal, or otherwise unprotected purposes, how should legitimate justifications for interfering with those activities (in the name of self defense, treaty enforcement, or maintenance of international peace and security) be weighed against the potential damage to the space environment?

3) How much and what type of verification, confidence-building, and compliance management arrangements would be appropriate in a regime where dual-use capabilities could be used, albeit often at great cost, in place of dedicated space weapons and where inadvertent interference poses at least as much of a threat to space assets as does purposeful interference?

These questions cannot be definitively answered on the basis of existing international space law or traditional arms control precedents. One basic problem is that many scenarios that concern space security experts do not fit neatly into the concept of physical transborder aggression that shapes the U.N. Charter's rules about the use of force and by extension the OST's basic distinction between "peaceful" uses of space that enjoy the right of safe passage, and other uses that have no such protections. For instance:

- If Taiwan declares independence and Beijing uses force to reassert sovereignty over the island, would satellites being used to support Chinese military operations have a right of safe passage, or not?

- What, if any, legal protections exist for satellites used by a country or dissident group to broadcast television messages urging citizens to overthrow their own government?[27]

[27] UNGA Res. 37/92, "Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting," (December 10, 1982) juxtaposes the right to seek and impart information and ideas with the directive to respect the sovereign rights of states and the principle of non-intervention, so it could support either side in this scenario. http://www.un.org/documents/ga/res/37/a37r092.htm. Two earlier accords could have some bearing. The 1936 International Convention Concerning the Use of Broadcasting in the Cause of Peace prohibits broadcasts to incite civil unrest or international war, but the United States and many other countries are not parties. The 1970 Declaration on Principles of International Law Concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations, generally considered part of customary law, includes the duty to refrain from propaganda for wars of aggression and the duty not to incite or support violence aimed at internal regime change in other states.

- Is there a legal right to use space for reconnaissance or commercial imagery collection if the user might have aggressive or otherwise illegal intentions?[28]

The OST and subsequent international agreements provide no clear-cut guidance about where the right of safe passage for peaceful purposes ends and the right of self defenses takes over. Thus, the countries with the most active military space programs have asserted that, for better or for worse, the OST's only operative constraints on military uses of space are its prohibitions on orbiting weapons of mass destruction and on conducting military activities on celestial bodies.

Although there are many other constraints on military space activities in treaty law, customary law, declaratory principles, and national rules of engagement, they cannot be aggregated into a comprehensive, coherent set of rules that would provide authoritative answers about which uses of space should be protected and when certain forms of interference should be prohibited or permitted.[29] Some rules are very narrow, such as when States Parties are prohibited from interference with satellites used to verify arms control compliance. Others, such as the admonition in the International Telecommunications Union's constitution against causing harmful interference to other countries' communications, include exemptions for military activities and for actions to block or limit transmissions that violate national laws or impact national security.[30]

Customary international laws are broad, binding on all states, and sometimes applicable during times of war as well as peace, but the ones most relevant to space conflict are also very subjective and permissive. For example, the customary International Law of Armed Conflict's principles of discrimination, proportionality, and necessity would prohibit deliberate attacks on space assets that serve no military function. But they would permit attacks on dual-use satellites, if the military advantage gained outweighed the collateral harm to civilian and neutral users on Earth, and there was no way to achieve the same military effect with less collateral damage. Some international lawyers have even suggested that if war

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[28] UNGA Res. 41/65 "Principles Relating to the Remote Sensing of Earth from Outer Space" (December 3, 1986) specifies that remote sensing should be conducted for mutual benefit and that the sensed state should have access to primary data and processed analyses of its territory on a non-discriminatory basis and at reasonable cost. In this statement of principles, though, remote sensing is defined as electromagnetic imaging being conducted for the purpose of improving natural resources management, land use and the protection of the environment, so the principles would not apply if the information was being collected or sold for aggressive purposes.

[29] U.S. military space lawyers have given these questions some thought, but with an eye to maximizing US freedom of action is space. See Maj. Elizabeth Waldrop, "Weaponization of Outer Space: US National Policy," *High Frontier* (Winter 2005) at Http://www.peterson.af/mil/hqafspc/news/images/journalwinter05.web and Michael N. Schmitt, "International Law and Military Operations in Space," *Max Planck Yearbook of United Nations Law,* Volume 10, 2006, pp. 89-125.

[30] Article 48 of the ITU Constitution states that members "retain their entire freedom with regard to military radio installations," but that they must, so far as possible, still observe ITU Constitution rules and Radio Regulations provisions regarding measures to prevent harmful interference and to minimize all interference with other States' radiocommunications.

was likely, it would not violate customary international law to deny an adversary the "high ground" of space by launching a debris cloud into orbit or detonating a high-altitude nuclear explosion.[31]

While all international law is underdeveloped compared with domestic law, international rules and governance mechanisms for space security confront particular complications that must be overcome in order for space rules to catch up with the rate of technological change and the spread of capability. One complication involves the historical separation of forums for discussing the military/arms control side of space security (primarily the CD) and the non-military/environmental side (e.g. the COPUOS). This separation is problematic because the same technology, indeed the same satellites, can often be used for both military and non-military applications. Another complication is the mismatch between the main international agreements and negotiating bodies for space (where states have the rights, responsibilities, and decision-making powers), and the current global space environment—in which commercial firms and non-state actors have comparable overall levels of space activity to governments, and where the same commercial or civilian satellite can be associated with different governments or customers. For instance, the OST assumes that a State Party will authorize and supervise all non-governmental space activities and that every object launched into space will be publicly registered to a State Party that controls it and accepts responsibility for any damage it might cause—yet actual practice has been far less orderly.[32]

These complicating features of space governance begin to demonstrate why traditional arms control models cannot be easily applied to space security. Most arms control accords have typically been designed to prohibit or regulate a type of weapon or weapons-related activity that can be segregated from permissible civilian or commercial uses of that same technology. The separation is sharpest in the nuclear case. But even in the case of chemical and biological agents and equipment with both legitimate and prohibited uses, the logic of their corresponding conventions assumes that signatories can differentiate between prohibited weapons-related activities and permitted or prophylactic ones based primarily on criteria such as the quantity of material and the characteristics of the owner (whether its commercial, scientific, or military).

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[31] Schmitt, "International Law," p. 117. The International Committee of the Red Cross, considered an authority on customary international humanitarian law, has asserted that customary international law would categorically ban any war fighting action that inflected "widespread, long-term and severe damage to the natural environment" including space, but the United States has countered that such actions could be justified as proportionate if sufficient military advantage could thereby be achieved. See Koplow, "ASAT-isfaction," pp. 88-90.

[32] In recognition of this problem, the General Assembly has recently passed two related resolutions. Res. 59/115 (December 2004) encourages launching states to "consider enacting and implementing national laws" authorizing and supervising the space activities of non-governmental entities under their jurisdiction. It also recommends that they volunteer information about their current practices regarding on-orbit transfer of ownership for space objects, and that States consider harmonizing their transfer practices. Res. 62/101 (December 2007) contains recommendations for improving the quantity, quality, and usefulness of information reported under the Convention on Registration of Objects Launched into Outer Space.

In space, the situation is much murkier. In addition to classical conceptions of space weapons—as dedicated anti-satellite weapons, space-based weapons that can hit terrestrial targets, or space-based missile defense interceptors—some space capabilities are dual-use and can be used in anti-satellite mode or for other purposes. An exoatmospheric missile defense interceptor, for example, could destroy a satellite circling Earth in a predictable orbit more easily than it could stop a ballistic missile suddenly launched at an unanticipated target. Low-powered, commercially available lasers used for satellite tracking and other legitimate purposes could temporarily blind imaging satellites.[33] And small, maneuverable satellites could conduct close proximity operations for benign reasons, such as taking diagnostic pictures of a malfunctioning satellite, or for malicious ones. There is no way to outlaw all capabilities that could be used as space weapons without also foregoing many beneficial applications.

Uncertainty about a satellite's function is as much of a problem for soft law as it is for formal arms control. Commercial space-based communication and imaging services are used extensively by the United States and increasingly by other countries to enhance their terrestrial military capabilities. In addition, governmental and non-governmental satellites can serve users from different countries, making it hard to determine when and what type of action against a satellite would be acceptable under international laws of armed conduct, including principles of necessity, proportionality, discrimination, and neutrality.

Instead of posing insurmountable barriers to arms control, these conceptual complications present compelling reasons for regulating behavior and not just capability (i.e., whether a technology fits criteria that define it as a "weapon" or that are used as a proxy for hostile intent). They suggest that trying to find the right balance between protecting peaceful uses of space and preventing aggressive, unacceptably threatening, or recklessly irresponsible ones, should be done through a discussion and negotiation process that includes all key stakeholders and is approached as an evolving and interactive project, rather than as an abstract intellectual exercise, a policy question to be answered separately by each space-faring state, or a static course of action where the rules, once negotiated, are set in stone. Perhaps most importantly, these complexities suggest that before trying to elaborate new rules for cooperative space security, parties need to decide on the fundamental purpose and guiding principle of their enhanced space security regime.

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[33] Low-powered laser beams are sent into space hundreds of times a year for various reasons, including tracking and imaging satellites, measuring distances between objects in space, calibrating instruments, and assessing continental drift. In 1997, the United States used high- and low-powered lasers against one of its own satellites to assess vulnerability to deliberate attacks and to the level of inadvertent lasing that might occur if a satellite crossed into one of these low-powered beams. For technical reasons, the United States could not collect complete information on the effects of the high-powered MIRACL laser, but it did determine that the 30 watt tracking laser, used longer than intended because of information collection problems, was sufficient to dazzle the imaging satellite at 500 km altitude. For an assessment of what can and cannot be done with low-powered lasers, see Wright, Grego, and Gronlund, *The Physics of Space Security,* pp. 125-128. Kenneth Bacon, "DoD News Briefing," October 23, 1997, http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=1103 describes the MIRACL laser test.

The Logic of a Reassurance-based Regime

As we have seen, the OST and other early rules for space security were developed to help stabilize terrestrial deterrence by providing two types of space reassurance: reassurance between the superpowers that they would tolerate each other's use of space for reconnaissance and other "stabilizing" military support activities and would forego highly destabilizing forms of space competition; and reassurance to other countries that the most advanced space-faring states would not try to lock out less developed countries from space but would share the benefits and show due regard for others' current and future space interests. In recent years, the United States has veered from this course and tried to establish a two-tiered set of rules for space security in which it, as the world's sole superpower, claimed almost complete freedom to use space for maximum national military and economic advantage, and could decide which other countries' uses of space were to be tolerated and which needed to be controlled, negated, or denied. This conception of comprehensive U.S. military space dominance has proven to be technically and economically unfeasible, as well as politically unacceptable to all other countries with space ambitions. But it remains an open question going forward whether a more appropriate guiding principle for space security would be an updated and strengthened form of reassurance or an extension of deterrence from terrestrial conflict into the space environment.

Some analysts, such as Bruce MacDonald and a group organized by the U.S. Air Force Academy's Eisenhower Center for Space and Defense Studies, have proposed that deterrence should become the central principle for space security policy.[34] At first glance, it would seem logical to extend terrestrial deterrence into space given that the United States can no more stop other countries from acquiring advanced military space capabilities or render its own space assets invulnerable than it can preserve its nuclear monopoly or physically prevent a nuclear attack. Anyone who credits deterrence with preventing a superpower conflict during the Cold War has reason to hope that an adapted form of deterrence could prevent attacks in space, too. Certainly, space deterrence would be technically more feasible and politically more acceptable than comprehensive U.S. space dominance has proved to be. Yet, there are a number of reasons why deterrence should not be enshrined as the new principle to guide space security policies, acquisition programs, and interactions among space-faring states.[35]

The central problem with nuclear deterrence holds true with space deterrence, too. How does a country convince a potential adversary that it has sufficient invulnerable military capabilities (in space or in other environments) to ensure that any benefits that the potential adversary might expect to gain by attacking would be outweighed by the costs of the response, without the first country building up its offensive capabilities to the point where they make the relationship more adversarial than it already is, provoke a pre-emptive response, cause another type of inadvertent deterrence failure, or generate a wasteful arms

[34] Roger G. Harrison, Deron R. Jackson, and Collins G. Shackelford, "Space Deterrence — the Delicate Balance of Risk," in *Space and Defense* (forthcoming).

[35] McDonald and the Eisenhower Center group are making recommendations for U.S. space policy; they do not consider the consequences for the U.S. or the rest of the global space community if other countries also reorient their policies to emphasize space deterrence.

race? Proponents of space deterrence are primarily concerned with the first half of that problem, but the second half is equally important and equally challenging. Satellites would be more vulnerable and ASAT attacks would be less directly destructive than nuclear weapons, so the prospects for both deliberate and inadvertent space deterrence failure would probably be higher than for nuclear deterrence. And since deterrence stability depends on credible commitments to attack if, and only if, the other side attacks first, the difficulties of reliable attribution in space would introduce additional complications. Without much more comprehensive space situational awareness than is currently available, it can be very difficult for a satellite operator to determine whether a malfunction was caused by an equipment or software failure, a natural space hazard, an inadvertent form of interference, or an ASAT attack, let alone to identify the alleged attacker and the place from which the alleged attack originated.[36]

In recognition of some of these problems, MacDonald and the Eisenhower Center group downplay aspects of a deterrence strategy that could be especially destabilizing or damaging to the space environment. Instead, they emphasize what they call "deterrence by denial" (primarily non-threatening ways of making satellites less attractive targets), "deterrence by entanglement" (restraint due to concerns about unpredictable and uncontrollable side-effects of damage to satellites on which countries depend for many non-military functions) and "deterrence by norms" (e.g., formal or informal rules that could dissuade other countries from interfering with U.S. satellites or acting in ways that damage the space environment by raising the political costs of these actions, or creating an expectation of long-term benefits from reciprocal restraint).

Most of their recommendations would fit equally well with a strategy where reassurance is the dominant principle and deterrence remains in the background, as it did for early-Cold War space policy and as it should be the case for post-Cold War nuclear relations among the United States, Russia, and China.[37] Trying to fit their recommendations into a deterrence framework rather one based on reassurance, though, leads the authors to suggest some hedging strategies to prepare for deterrence failure that would have the unintended effect of making both deterrence and diplomacy more likely to fail. For example, they

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[36] Harrison, et al., "Space Deterrence," pp. 15-16. The authors judge that while it might be difficult to determine the origin and identity of an individual act of interference, especially by jamming or dazzling, it would be highly unlikely that an adversary could destroy a significant portion of US space assets without being identified as the culprit. Perhaps a more plausible scenario is one that they barely mention: that during a time of crisis, a satellite malfunctions due to a natural hazard, a collision with space debris, or an internal failure, but decision makers incorrectly interpret the malfunction as an ASAT attack and attribute it to the other side in the crisis.

[37] Early U.S. efforts to promote reciprocal restraint in space included low-level ASAT work to signal to the Soviets that the U.S. could retaliate if the Soviets attacked U.S. satellites and could speed up its ASAT development and deployment efforts if the Soviets seemed serious about putting weapons in space or developing an advanced ASAT capability. In response to some Soviet ASAT tests in the late 1960s, an interagency working group chaired by Manfred Eimer considered whether the US should intensify its own ASAT efforts, but concluded that this was less likely to be a robust deterrent, and more likely to stimulate further Soviet ASAT tests, undermine mutual restraint in space, and reduce overall US space security. See Steven Weber and Sidney Drell, "Attempts to Regulate Military Activities in Space," in Alexander L. George, et al., *U.S.-Soviet Security Cooperation,* New York and Oxford: Oxford University Press, 1988), pp. 390-1.

recommend continuing to conduct war games and crisis simulations involving U.S. and Chinese offensive counterspace warfare, developing temporary and reversible means to negate others' space capabilities, and perpetuating U.S. superiority both in military space capabilities and in terrestrial capabilities to fight even without reliance on space assets.

While deterrence may have been the most viable organizing principle for Cold War security, given the intense ideological rivalry between the superpowers and the extraordinary destructive power of nuclear weapons, neither is a basic feature of current space security policy. Today, the main space-faring states have far more common interests than they have conflicting ones. Each has the means to interfere with others' use of space, but few interference scenarios would benefit a state more than it would harm it. The fact that multiple states could use a military or space capability designed for another purpose as an ASAT if their own satellites were attacked probably has a residual deterrent effect, but this is not the main reason states have consistently refrained from attacking each other's satellites. If states were to make such deterrence relationships the dominant principle guiding military and diplomatic efforts to enhance space security, they would promote and institutionalize an unnecessarily adversarial and military-dominated approach to space security.

From a strategic standpoint, the fundamental problem of security in space has remained constant—i.e., how to provide enough reassurance that others tolerate and maybe even facilitate your space activities. The context for this question, though, has shifted from one where two roughly equal adversaries were locked in a deterrence relationship to a much more asymmetrical and highly interdependent world. Long after the end of the Cold War, the United States maintains military superiority in space and on Earth, but its greater dependence on space means that there is also relatively greater U.S. vulnerability to deliberate or inadvertent interference. As information technology becomes more central to the global economy, many countries see it as strategically important to have their own basic space capabilities for development, economic growth, political influence, and military modernization. Yet, the global spread of space capabilities also distributes the rudimentary means to interfere with others' space assets.[38] Because it is technically and economically impractical to protect unilaterally all the governmental and commercial satellites on which it depends, the United States needs reliable reassurance that other countries will neither use their space-related capabilities to attack its satellites nor engage in irresponsible space behavior that puts these satellites at risk. The rest of the space-faring world also seeks reliable reassurance that the United States will be a "responsible" space power: that it will abide by the same rules as everybody else does, that it will respect other countries' rights to use space freely in the same ways it does, and that it will not exploit space for unfair military or commercial advantages. Furthermore, they want reassurance that they can have a place at the table when key decisions affecting their use of space are made.

Such a reassurance-based, cooperative security regime for space would differ from traditional arms controls in several important respects. Contrary to traditional arms controls, which sought to stabilize deterrence by minimizing an adversary's incentives to initiate or escalate a nuclear war and maximizing incentives for restraint, a reassurance-based space security regime would try to maximize everybody's ability to use space for peaceful purposes while minimizing deliberate or inadvertent interference.

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[38] Joan Johnson-Freese, *Space as a Strategic Asset* (NY: Columbia University Press, 2007), pp. 9-10.

Traditional arms control and nonproliferation regimes have used secrecy and export controls as additional means to prevent some states from developing certain types of weapons that others already have. A reassurance-based space security regime would acknowledge that secrecy and export controls often impede legitimate space commerce and cooperation without preventing the spread of space-related capabilities that could be misused. In other words, it would assume that the most reliable form of protection permits the free flow of most space-related information and technology while it develops equitable rules and monitoring procedures to differentiate between legitimate and hostile or irresponsible uses.

Traditional arms control treaties have often tried to specify obligations in fine detail so that each party knows in advance what is permitted or prohibited. A reassurance-based regime for space security would include agreed-upon processes through which members can decide how to apply broad principles to specific cases and determine how the rules might need to be modified or supplemented to keep pace with technical and strategic changes.

Finally, traditional arms control has often approached verification and compliance measures as additional opportunities for adversaries to compete for strategic advantage, with verification being depicted as an information control game between "hiders" and "finders," and highly politicized non-compliance accusations being used to call for "immediate, swift, and sure" punishment or retaliatory treaty withdrawal.[39] A reassurance-based approach would use systematic transparency as a means to increase mutual benefits from cooperative arrangements. Agreed mechanisms for collecting and exchanging information to document compliance would increase overall confidence in space security and identify compliance concerns that would warrant a regulatory management response. They could also provide additional benefits by making it easier, safer, or less expensive for members to accomplish other peaceful objectives in space. For example, with or without new arms control agreements in space, both states and nongovernmental organizations have an interest in improving overall space situational awareness—i.e., knowledge about what is in space, what it is doing there, and how it is moving in relation to other space objects.[40] The same information needed for avoiding collisions and assessing the health of the space environment could also be useful for verification. Countries and commercial operators will be much more willing to share this type of information, and to broadly support increasing the total quantity and quality of shared information, if these efforts are undertaken in the context of a space security regime that reassures participants that collecting and sharing such information will allow them to benefit from space, reduce the risk of collisions, and will not be misused for competitive purposes, be they commercial or adversarial.

[39] The "hiders and finders" model of verification was developed by Amrom Katz in a 1961 *Bulletin of the Atomic Scientists* article, while the phrase "immediate, swift, and sure punishment," was used by Bernard Baruch in his opening speech to the United Nations Energy Commission on June 14, 1946.

[40] The need for cooperative steps to improve both the collection and the distribution of information about space objects is explained by Brian Weeden, "The numbers game: What's in Earth orbit and how do we know?" *The Space Review* (July 13, 2009), at http://www.thespacereview.com/article/1417/1.

A Reassurance-based Process for Enhancing Space Security

Given the urgent need for action to ensure space security and sustainability, the decades-long inability of the CD to address this topic, and the differences between the kinds of traditional arms control measures that the CD was designed to negotiate and a reassurance-based approach to space security, it is worth asking how the rule-making process might be handled more effectively. Some have proposed changes to the CD's operating practices, while others have suggested abandoning efforts to negotiate and ratify treaties and relying instead on Codes of Conduct and other informal policy coordination. The Canadian working paper proposed one way to blend these two positions: using the CD to negotiate new complementary rules that would be politically binding at first, and become legally binding later. But the only reason why it might be easier to get agreement in the CD on new norms than on legal obligations is that states would have greater latitude in interpreting those norms as they see fit and ignoring them when inconvenient. An alternative approach would be to step outside the CD, at least for the time being, and create a new negotiating process that is optimized for the special features of space and would facilitate steps towards reassurance-based cooperative security.

The CD's inclusive make-up, its consensual decision-making rules, and its proven ability to negotiate legally binding treaties, give many countries a stake in upholding the position that the CD is the best forum for tackling core issues of space security. But given the huge number of pressing security challenges on the global agenda, it may make sense to let the CD focus on the issue at the top of its negotiating agenda (a fissile material treaty) and to agree by consensus on entrusting space security to a special forum that shares the best features of the CD—inclusivity, decision-making procedures that respect all stakeholders' interests, and the ability to negotiate legally binding rules and compliance management mechanisms when the time is right, not just declarations of principles or Codes of Conduct. Taking space security off the CD agenda could even strengthen the standing of the CD if that development makes it easier for the CD to concentrate on other pressing security problems that are more amenable to progress under the CD's established process.

Arguably, the CD is both too large and too narrowly focused on traditional military and arms control issues, to make it the optimal forum for rapid progress on cooperative space security. A dedicated forum, either in Geneva or Vienna to share resources and expertise with the CD or COPUOS, or in a new venue to symbolize a fresh, more balanced outlook on global security, would attract a smaller group of states particularly concerned with space security. It would also encourage the formation of delegations that more accurately represent the mix of military, civilian, and commercial interests in space, rather than the status quo in which military/arms control issues are discussed in the CD and civilian/commercial issues in COPUOS.

An important feature of space governance is that everybody has a stake in space security, but each stakeholder has particular levels of investment, expertise, and impact. Any new forum would need to be inclusive and representative enough to be widely viewed as legitimate, without becoming unwieldy. The best arrangement would include a governance mechanism that puts a larger burden of responsibility and decision-making power in the hands of those countries that care the most and whose constructive involvement is the most important for space security, without creating an inherently discriminatory structure.

Because the United States, Russia, and China have the most advanced military space programs, have each conducted ASAT tests, and are the most focused on the strategic side of space security, they need to be constructively engaged from the outset. But if the initial phase of negotiations involved only these three countries, the deliberations would arguably be too heavily focused on the military side of space security and too likely to devolve into traditional arms control arguments. Using technical criteria to decide which other states to include in initial deliberations, such as a state's ability to launch objects into space, would not necessarily be a good option either. Doing so would allow some countries whose participation was not essential to play a spoiler role, while excluding other countries, such as Canada, which has an active space program and a long-standing interest in cooperative space security. The best option might be to invite all countries who have demonstrated a significant interest in space security to participate in the discussions and eventual negotiations, but to set participation costs sufficiently high so that only those countries that have a major stake in the outcome would likely choose to be active participants.

The Antarctic Treaty offers one model of a flexible, non-discriminatory way to authorize decision-making powers depending on a state's demonstrated level of interest and commitment.[41] At the invitation of the United States, the main treaty was negotiated in less than three months by the twelve countries participating in the International Geophysical Year of 1957-58. This group included all seven countries that had claimed sovereignty over areas of Antarctica and most of the other countries that had engaged in scientific exploration there. The treaty created two categories of members, which have come to be known as Consultative and Non-Consultative. All original signatories are Consultative members, as is any country that acceded to the treaty and demonstrated their interest in Antarctica by "conducting substantial research activity there."

Representatives of the Consultative members meet at semi-regular intervals to exchange information, discuss treaty-related matters, and develop recommendations regarding additional measures to further the principles and objectives of the treaty. Non-Consultative members can attend these meetings as observers. The treaty may be modified or amended by the unanimous agreement of Consultative members, and proposed changes enter into force upon ratification by all Consultative members. Non-Consultative members have two years after the changes enter into force to ratify them. If they do not, they are deemed to have withdrawn from the treaty, presumably for lack of interest. The only withdrawal provision covering Consultative members includes an option to call for a 30-year treaty review conference, at which changes to the treaty could be approved by a majority vote, including a majority of Consultative members. If these changes are not ratified by all Consultative members after two years, then any treaty member can give notice of its intent to withdraw in a further two years' time.

The Antarctic Treaty example also illustrates the benefits of developing a cooperative security system through an iterative process, with key players making firm enough commitments up front that others know they are serious but leaving enough flexibility for the depth and breadth of cooperation to increase over time. After starting out with 12 members, the Antarctic Treaty now has 28 Consultative and 18 Non-Consultative members.

[41] The text of the 1959 Antarctic Treaty is at: http://www.ats.aq/documents/ats/treaty_original.pdf and additional information about the Antarctic Treaty System is at: http://www.ats.aq/e/ats_treaty.htm.

It has never been amended, but all Consultative members and some Non-Consultative members have ratified an Environmental Protocol and a separate Convention on the Conservation of Antarctic Marine Living Resources. The treaty system also includes a convention with a lower level of participation, and the ratification process has just begun for legally binding rules on tourism adopted at the 2009 Consultative meeting.

In the Antarctic Treaty case, the organizing impetus came from the United States. As the dominant space power, the United States is best positioned to demonstrate leadership in this case, too. The Bush administration did champion some forms of space cooperation, especially by encouraging other countries to adopt and follow space debris mitigation guidelines and challenging China to be more transparent about its space programs. But the Bush administration was not willing to change U.S. space behavior in ways that other countries would have found reassuring. Nor was it willing to commit to a process to connect voluntary transparency and confidence-building measures with legally binding steps to enhance mutual space security.

There are a number of steps that the Obama administration could take to demonstrate leadership in building a reassurance-based approach to space security. It could explicitly renounce coercive prevention as the central principle of U.S. security policy; repudiate those elements of the 2006 National Space Strategy that are inconsistent with the Outer Space Treaty and that reject the idea of making new legally binding commitments; and increase the transparency of U.S. military space spending. Any one of these steps would signal to other key countries that the United States is now seriously interested in exploring space agreements that could help address all participants' core security concerns. Given the Obama administration's other priorities, though, and domestic pressures that weigh against anything that could be construed as a unilateral concession, such U.S. policy changes may be slow in coming unless other countries that care about space security keep trying to move the issue forward.

One way to jump start movement on space security would involve a different variation on the process that produced the Outer Space Treaty than the option advanced by the Canadian working paper. Instead of encouraging the CD to negotiate a comprehensive set of soft-law principles for space security that could become legally binding obligations at a later date, the fastest way to shore up existing normative barriers against deploying weapons in space and harmful interference with satellites would be to induce the United States, China, and Russia to make parallel, unilateral declarations pledging not to be the first country to place any weapon on orbit or to interfere with satellites operating in a manner that would be considered peaceful and consistent with the OST. As with the 1963 U.S. and Soviet declarations that they would not place weapons of mass destruction in space or on celestial bodies, these parallel unilateral declarations could be endorsed by a U.N. General Assembly resolution that calls on other states to exercise similar restraint and to negotiate a cooperative regime for space security, either in the CD or in a special forum established for that purpose.

It is not unrealistic to hope that the United States, Russia, and China could be induced to issue such declarations at the U.N. General Assembly. Russia has already unilaterally and unconditionally declared that it will not be the first country to deploy

offensive strike weapons in space.[42] Both Russia and China have a strong interest in reinforcing international norms against weapons in space and the threat or use of force against space objects, especially if parallel unilateral declarations were the first step in an agreed process for moving from broad political declarations to legally binding obligations.

There are good reasons, too, for the United States to take this initial step. It would continue the current state of affairs and enhance the credibility of U.S. claims that it has neither fielded weapons in space nor is currently funding space weaponization programs.[43] It would support the U.S. desire for a moratorium on further debris generating ASAT tests, but would not preclude anything that the United States is highly motivated to do. Ruling out space-based interceptors for missile defense would be a smart move because this basing option is the least technologically mature, the most expensive, the most vulnerable, and the most threatening to China and Russia. Therefore, the United States would not be precluding any options to protect national security, and it could have a much more constructive international conversation about missile defense if this option were off the table.[44]

Envisioning a Reassurance-based Regime for Space Security

Encouraging states to take the first steps towards a reassurance-based regime for space security could be helped along by a shared vision of the desired end-state, since the concept of a reassurance-based space security regime is much broader and less familiar than other space security proposals. As has been noted in discussions about achieving a nuclear weapons-free world, a bold vision to guide action on incremental measures can make those actions seem more urgent and fair, while breaking the bold vision down into component actions can make the desired end-state seem more realistic and achievable.[45] By discussing the goals of a reassurance-based regime for space security and breaking the regime down into its constituent elements, states can also see how modest steps can be mutually reinforcing pieces of a much more ambitious and consequential project.

The following proposal about potential elements of a fully developed reassurance-based regime for space security is intended as a stimulus for discussion and for creative

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[42] Statement by Vladimir Putin, U.N. General Assembly, September 25, 2003.

[43] See Marc Kaufman,"Bush Sets Defense as Space Priority — U.S. Says Shift if Not a Step Toward Arms; Experts Say it Could Be," *Washington Post* (October 16, 2006) and Peter B. de Selding," Pentagon Official: U.S. is not Developing Space Weapons," *Space News* (February 20, 2008), http://www.space.com/news/090220-pentagon-space-weapons.html. Such comments undoubtedly use a very narrow definition of space weapons, but if the US government wants such reassurances to be taken seriously, then the proposed policy declaration would be a good step.

[44] According to a study by the person nominated to be the White House Office of Management and Budget's Associate Director for Defense and International Affairs, stationing weapons in space is a very expensive and vulnerable way to accomplish most military objectives compared with terrestrial alternatives. See Steven M. Kosiak, "Arming the Heavens: A Preliminary Assessment of the Potential Cost and Cost-Effectiveness of Space-Based Weapons," Center for Strategic and Budgetary Assessments (2007), http://www.csbaonline.org/4Publications/PubLibrary/R.20071031.Arming_the_Heavens/R.20071031.Arming_the_Heavens.pdf.

[45] Description of Nuclear Security Project led by George Shultz, William Perry, Henry Kissinger, and Sam Nunn, at: http://www.nuclearsecurityproject.org/site/c.mjJXJbMMIoE/b.3534665/k.5828/About_the_Project_Index.htm.

thinking about how existing resources could be combined and expanded into something much more valuable than the sum of the original parts. Many of the elements would require unprecedented forms of cooperation, but such cooperation would be much closer to current practice than is the vision of a nuclear weapons-free world. Building a reassurance-based regime for space security should also be easier than eliminating nuclear weapons because the most consequential security commitments in regards to space involve continuing to refrain from doing things that have never been done before—i.e., not deploying weapons in space or attacking other countries' satellites. By contrast, nuclear elimination requires the most powerful countries in the world to give up tens of thousands of weapons that have constituted the centerpiece of their security policy for the last 60 years.

Indeed, establishing some type of reassurance-based regime for space security may be a prerequisite for eliminating nuclear weapons. Certainly, Russian and Chinese leaders have indicated that the failure to prevent the weaponization of space would destabilize their strategic security and that they will not consider deep cuts to their nuclear arsenals if they believe that the United States will offset its nuclear reductions by deploying more useable space-enabled conventional global strike weapons. Even if one is not literally a prerequisite for the other, progress made and lessons learned in the space case would create a more favorable context and set valuable precedents for the nuclear one.

At this critical juncture in history, though, it is more important to start holding serious discussions about cooperative steps to address core space security concerns than it is to know exactly what the desired end product of those discussions would be. The very process of governments formulating their positions for space security negotiations would arguably encourage as much restraint and responsible behavior in space as would any formally adopted rules. It would prompt more agencies to get involved in national deliberations over space security policy; it would encourage countries to invest in the technical, diplomatic, legal, and other expertise needed for space security; it would compel countries to think more carefully about the international security implications of the space technologies they are pursuing; and it would create a structured forum in which the states with more advanced military space capabilities could talk about how jointly developed rules and unilateral precedents are likely to play out in the future, when many more countries are capable of doing what only one or a few can do today.

ANNEX

Elements of a companion agreement to OST:

1. All countries have the right to access and use space for peaceful purposes, on a basis of equality and in a responsible manner that does not cause potentially harmful interference with other countries' current or future use of outer space for peaceful purposes. All countries have a corresponding obligation to provide reassurance that their space activities are peaceful and responsible.

2. States Party to this treaty may chose Executive membership or Associate membership. Executive members have representation on the Executive Council and are assessed at a higher rate for the costs of the implementing Space Security Organization. All members participate in the Conference of States Parties, follow the rules of responsible space-faring behavior, and receive basic space surveillance information. As their use of space expands, Associate members may upgrade their membership to the Executive level with one year's notice. Non-state entities with a significant stake in space security may apply for observer status as Affiliates.

3. No State Party shall encourage, cause, assist, or otherwise participate in space activities by non-States Parties or other space users that are inconsistent with any provisions of this Treaty.

4. During launch, operation, and end-of-life phases, each satellite must be registered to a state that bears international responsibility for ensuring that all activities are carried out in conformity with this Treaty, the Outer Space Treaty, and other space security agreements. The Technical Secretariat of the Space Security Organization created by this Treaty should maintain an expanded and centralized Space Registry, which would include pre-launch notifications; basic information about the function, operator, and orbital parameters of operational satellites; and plans for the safe disposal of the satellite when it reaches the end of its lifetime. This information should be reported in a standardized form that can be integrated with the Space Surveillance System operated by the Technical Secretariat. Responsibility for a satellite can be passed from a launching state to an operating state and from an operating state to a disposal state by means of a co-signed notification to the Technical Secretariat.

5. Peaceful purposes exclude the placement of any type of weapon in outer space. They include the use of space-based information and communication systems for military and intelligence purposes that are consistent with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.

6. Disputes about uses of space for hostile or coercive purposes that fall within the grey zone of international law, neither clearly aggressive nor defensive, may be brought to the Executive Council for a determination as to whether or not that

space activity is peaceful, and thus protected. In grey zone cases, consideration shall be given to whether or not the states involved are members in good standing of this Treaty, the Outer Space Treaty, and other space security agreements.

7. Each State Party undertakes not to place weapons in outer space or to test, or use any capability as a weapon against any peaceful satellite so as to damage or destroy it.

8. If a satellite is being used for purposes that are not peaceful, and thus are not protected, the situation should be addressed first with diplomatic measures. If diplomatic measures fail to resolve the problem, additional steps may be taken, consistent with international law, so long as they are proportionate, discriminate, and cause the least necessary damage to the physical and security environment of space.

9. To increase responsible behavior, provide reassurance about the peaceful use of dual-capable technologies, and to minimize inadvertent harmful interference, all States Parties shall adhere to the behavioral rules listed in Protocol A and should respect the voluntary guidelines listed in Protocol B. Additional transparency and confidence-building measures may be negotiated as side agreements or adopted on a voluntary basis by any subset of States Party to this agreement.

10. The Executive Council shall review the rules listed in Protocols A and B on an annual basis, and shall make recommendations when needed to modify the rules or their legal status in light of technological developments, new information about problematic or best practices, or other relevant changes in the physical and security environment of space. Changes to Protocol A require the unanimous support of the Executive Council and approval by two-thirds of the Conference of States Parties. Updated versions of Protocol A supersede earlier versions through an Executive Agreement. Changes to Protocol B require approval by two-thirds of the Executive Council before joining the record of voluntary best practices.

11. If an uncontrollable space object poses an inadvertent threat to space security or terrestrial security, the Executive Council shall decide whether that threat is severe enough to override any damage that might be done to the physical and security environment of space by the least destructive option for removing the threat.

12. The Space Security Organization shall include a Technical Secretariat that shall assist States Parties with the implementation of the Treaty, carry out the verification and other functions entrusted to it by the Treaty, help build States Parties' capacity to comply with their obligations, promote voluntary adherence by non-members to the rules and guidelines contained in this Treaty, and perform additional functions as directed by the Executive Council for the purposes of preserving space security and enhancing all countries' ability to use space safely for peaceful purposes.

13. The Technical Secretariat shall operate a Space Surveillance System that provides all space users with the data and analysis deemed necessary by the Executive Council for safe operations and mutual reassurance about the peaceful nature of all space activities. This system could begin with pooled data from national systems or could be based on sensors owned and operated by the Space Security Organization. The quality and quantity of data and analysis provided could increase over time as states become more confident about sharing relevant information or as the density of space usage necessitates closer levels of coordination. While the Technical Secretariat could provide more information and services to Executive Council members, which bear more of the costs of the Space Security Organization, or alternatively to all members in good standing compared with non-members, data or analysis from the Space Surveillance System should never be withheld from any space user if there is a non-trivial possibility of an accident that could put other users' space assets at risk.

14. To provide reassurance that all space activities are being conducted safely and for peaceful purposes, and to verify compliance with the other obligations in this Treaty, States Parties shall rely on the information reported to the Registry, on the Space Surveillance System, and on any additional multilateral verification measures that the Executive Council decides unanimously are necessary to provide all members with confidence that the overall level of compliance with the Treaty is consistent with their national security. For the purposes of verifying compliance with this Treaty, States Party may also use information obtained by national technical means in a manner consistent with international law. Subsets of States Parties may also negotiate complementary verification side agreements so long as they report the basic findings to the Executive Council in a way that provides additional reassurance and confidence in compliance to all members.

15. If disputes or concerns about compliance arise, Member States shall work individually, through the Technical Secretariat, and/or through the Executive Council to reach agreement about the nature of the problem and to restore full confidence in compliance. States shall respond to requests for information and consultations in a timely and constructive manner.

16. When the problem stems from a lack of state capacity to comply with obligations, Member States or the Technical Secretariat should provide assistance in the development and implementation of a plan that meets Executive Council approval whereby the state in question would cease, curtail, or outsource the activities in question until they can be carried out in a manner that is Treaty compliant.

17. When the problem stems from a disagreement over existing obligations or ambiguities about how agreed principles apply to a specific situation, the Executive Council will endeavor to reach a consensus judgment about the relevant rules and the steps that should be taken to restore full confidence in compliance. If a consensus cannot be reached in a timely manner, the Executive

Council shall decide by a two-thirds vote whether the matter lies outside the domain of the Space Security Organization, whether it lies within the domain but the rules require further elaboration by the Executive Council, or if the case for noncompliance is clear-cut and sufficiently persistent that enforcement actions should be taken.

18. To increase the credibility and effectiveness of enforcement mechanisms, the Executive Council shall develop a graduated set of response options that correspond with the urgency and seriousness of the threat that an unresolved violation would pose to military or environmental aspects of space security. The lower tiers should include measures that are completely within the control of the Space Security Organization's Executive Council, such as reduced access to the benefits of being a member in good standing and a reduction or suspension of decision-making powers in the Organization. The upper tiers would include measures, such as mandatory economic sanctions, political sanctions, or use of force, which would require U.N. Security Council authorization.