



The Role of Transparency and Confidence-Building Measures in Advancing Space Security

Report 28
September 2010

Jana Robinson



Short title: ESPI Report 28
ISSN: 2076-6688
Published in September 2010
Price: €11

Editor and publisher:
European Space Policy Institute, ESPI
Schwarzenbergplatz 6 • 1030 Vienna • Austria
<http://www.espi.or.at>
Tel. +43 1 7181118-0; Fax -99

Rights reserved – No part of this report may be reproduced or transmitted in any form or for any purpose without permission from ESPI. Citations and extracts to be published by other means are subject to mentioning "Source: ESPI Report 28; September 2010. All rights reserved" and sample transmission to ESPI before publishing.

ESPI is not responsible for any losses, injury or damage caused to any person or property (including under contract, by negligence, product liability or otherwise) whether they may be direct or indirect, special, incidental or consequential, resulting from the information contained in this publication.

Design: Panthera.cc

Table of Contents

Executive Summary	4
1. Introduction	11
2. Terrestrial TCBMs: Lessons Learned	14
2.1 TCBMs in Arms Control and Nonproliferation Agreements	14
2.1.1 Cold War Arms Control	14
2.1.2 Multilateral Accords	18
2.2 Current Status of Terrestrial TCBMs	22
3. Space-Related TCBMs	27
3.1 Current Proposals for Organising, Managing, and Regulating Space Activities	27
3.1.1 Top-Down Proposals	28
3.1.2 Bottom-Up Proposals	30
3.2 Threats to Space Security Necessitating Use of TCBMs	34
3.3 TCBM Options	39
3.4 Advantages and Limitations of Space-Related TCBMs	50
4. TCBMs and EU Draft Code of Conduct	52
4.1 Establishing Consensus on Behaviour to Enhance Space Security	53
4.2 EU Code and Future Cooperative Space TCBM Architecture	59
5. Conclusion	61
6. Recommendations	62
Annex: TCBMs in Arms Control and Non-proliferation Endeavours	67
A.1 Arms Control in the Cold War Context	67
A.2 Multilateral Nuclear Non-Proliferation Efforts	73
A.3 Multilateral Non-Nuclear Non-Proliferation Efforts	82
A.4 Conventional Technology Control	84
A.5 Weapons-Elimination Efforts	87
List of Acronyms	90
Acknowledgements	93
About the Author	93



Executive Summary

Background

“Terrestrial” transparency and confidence-building measures (TCBM) have been employed for decades and had a special role during the Cold War. Although TCMBs were included in the provisions of space treaties and major resolutions, the use of the term for space has been relatively recent. Naturally, space is not free of serious challenges and space-faring nations have to be cognisant of threats to safe and secure operations. These include, among others, space debris, safety of space operations (including launch and re-entry), limited availability of electromagnetic spectrum and geostationary orbit slots, space weather, as well as disruptive counterspace actions. Incidents in space, although rare, have occurred and highlighted the growing risks associated with operations in space. These subjects are now commanding more animated attention in numerous multilateral and bilateral venues, not to mention in space-faring capitals.

Transparency has been defined for the purpose of this study as “the degree of openness in conveying information and a device of strategic negotiations signalling the trustworthiness of the actor in negotiations”.¹ Other confidence-building measures employed in the past include informational measures that involve going public with information about a government’s policies and intentions; consultative modalities seeking to facilitate dialogue between nations to reduce tensions and the risk of armed conflict by instituting preventive mechanisms; notification requirements offering advance warning of a state’s plans to conduct certain activities; constraint mechanisms discouraging or prohibiting certain types of activity; and, finally, access measures allowing states to monitor each other’s behaviour as well as verify compliance.

Naturally, different nations have differing priorities and reaching agreement on mutually- acceptable TCMBs is difficult, but not impossible. TCMBs have generated often well-deserved scepticism largely stemming from those occasions when it was perceived that significant concessions were made for

very little, if anything, in return. Despite these harsh realities, there recently appears to be more willingness to forge achievable and pragmatic TCMBs, especially given the reluctance of countries to sign up to legally-binding treaties that deal with security risks.

While acknowledging the limitations of TCMBs, they will almost certainly play an essential role in securing space for future generations. States possessing an advanced understanding and commitment to international law are going to be essential for creative and persuasive space diplomacy and conflict resolution. In the maritime world, those operating at sea share a similar culture and tend to respect international law and customs as well as confidence-building measures.² A similar culture can – and does – exist among “space-goers” which offers real promise with respect to the adoption of common norms of behaviour.

The study focuses on transparency and confidence-building measures (TCBM) as traditional tools of diplomacy and international relations. It first discusses TCMBs in the current international environment and how “terrestrial” TCMBs employed in the areas of arms control and nonproliferation efforts can serve as guideposts in configuring similar measures for space. It then focuses on threats to space security necessitating the use of TCMBs and how they can be implemented within the framework provided by proposed space security management mechanisms. The EU Draft Code of Conduct for Outer Space Activities is likewise evaluated as a framework that could be viewed, if accompanied by the right mix of TCMBs, as a suitable space security concept which could garner broad international support.

When reviewing terrestrial TCMBs, the main focus was placed on managing nuclear and missile proliferation issues. Nuclear weapons consultations have primarily centred around the five legally recognised nuclear weapons states (NWS). Transparency measures during the Cold War were mainly a function of the U.S.-Soviet competition. The first major

¹ Ball, Carolyn. “What is Transparency?” *Public Integrity* 11.4 (2009): 297.

² Griffiths, David. “U.S. – China Maritime Confidence-Building: Paradigms, Precedents and Prospects.” *China Maritime Study* 6. Newport: Naval War College, China Maritime Studies Institute (2010): 9.

commitment to nuclear transparency was embodied in the 1963 Limited Test Ban Treaty (LTBT), and later, for example, the 1968 Nuclear Non-Proliferation Treaty (NPT). With regard to missiles, the Anti-Ballistic Missile (ABM) Treaty, banning development, testing, and deployment of sea-based, air-based, space-based, or mobile land-based ABM systems or components, was a major security agreement implicating space. The 1987 Intermediate-Range Nuclear Forces (INF) Treaty became the first nuclear arms control agreement to actually reduce nuclear arms and introduced on-site inspections and a comprehensive verification regime.

However, transparency is often trumped by secrecy for a host of reasons, including the deterrent value of withholding certain information. In nuclear arms control, there is no common approach to nuclear weapon holdings which complicates comparative assessments. Moreover, key technical aspects of existing weapons systems are classified, and data exchanges and inspections have an uneven track record. Proliferation also remains a daunting challenge as evidenced by the A.Q. Khan's efforts beginning in the 1970's. Ballistic missile proliferation is an even more frequent concern because of the relative ease of this abuse since space launch vehicles and ballistic missiles for military purposes employ much of the same technology.

In Europe, the Conventional Forces of Europe (CFE) Treaty provided the most important, legally binding and relatively verifiable undertaking, limiting the size of conventional ground and air forces that states may maintain. Although a valuable stabilising agreement, the CFE continues to struggle with ratification of the Adaptation Agreement by a majority of its signatories. Similar problems can be detected in legally non-binding arrangements, like the Hague Code of Conduct, which has some 130 signatories, but excludes major states with ballistic missile capabilities.

In short, bilateral agreements tend to be easier to achieve, but multilateral agreements have the benefit of imbuing states with greater responsibility disciplined by peer pressures. Moreover, as governments seek the proper balance between transparency and national security concerns, understanding the process and modalities of implementing TCBMs, as well as risks and benefits associated with these measures, is essential if they are to be effective.

Space-Related TCBMs

There exist "top-down" agreements initiated by governments, and "bottom-up" approaches to managing activities in space.

Although no uniform definition of these approaches has been adopted, it can be argued that both involve governments at a certain stage. In the initiation, negotiation, adoption, and implementation of new policies, the top-down approach involves the government from the outset. The bottom-up concept generally begins with non-governmental entities (e.g. academia, think tanks, scientific communities, etc.) in the initial stage. Bottom-up policy development helps create frameworks for specific, narrow purposes until the sum of these "stove-piped" policies achieves, or at least nears, the overarching goal of more comprehensive rules for space conduct. Ultimately, the negotiation and adoption process of both approaches is carried out by governments. Implementation can involve both governments and non-governmental entities.

Top-down structures are represented by, for example, the 1967 Outer Space Treaty (OST). Currently, bottom-up proposals have enjoyed broader acceptance as the most viable way of managing space activities internationally. The principal argument is that an informal structure can, over time, positively influence the overall security matrix, and even lead to a broader formal agreement. The COPUOS-based "Long-term Sustainability of Outer Space Activities" initiative is a good example.

TCBMs are present in existing, legally binding space agreements and related UN resolutions. The concept of TCBMs in space was adopted by the UN, for the first time, via Resolution 60/66 entitled "Transparency and Confidence-Building Measures in Outer Space Activities".³ Space TCBMs were likewise introduced in a 2006 Russian and Chinese working paper (CD/1778) and led to a number of UN Resolutions on TCBMs.⁴ Existing TCBMs for space carry benefits as well as associated baggage. Both Russia and China, who proposed the CD-related TCBMs, are proponents of a legally-binding treaty on banning space weapons. As referenced earlier, there is also a history of TCBM disappointments, especially in the arms control and proliferation arenas. These mixed results complicate persuading some space actors of the benefits of TCBMs for non-binding agree-

³ United Nations General Assembly. Resolution adopted by the General Assembly entitled "Transparency and confidence-building measures in outer space activities." UN Doc. A/RES/60/66 of 6 Jan. 2006. New York: United Nations.

⁴ Conference on Disarmament. "Working Paper: Transparency and Confidence-Building Measures in Outer Space Activities and the Prevention of Placement of Weapons in Outer Space." Doc. CD/1776 of 22 May 2006. 26 July 2007. <<http://www.reachingcriticalwill.org/political/cd/papers06/22MayChinaRussia1.pdf>>.



ments. That said, as bottom-up approaches to managing space activities require supportive mechanisms, TCBMs, in the right circumstances, will serve as an indispensable tool for positive outcomes.

The EU Draft Code of Conduct for Outer Space Activities

Europe generally favours diplomatic solutions and seeks to establish itself as a “principled” player on the global political scene, including in space. The EU Draft Code of Conduct for Outer Space Activities, adopted during the French Presidency in December 2008, is the most visible manifestation of this thus far. It represents a non-treaty-based effort to advance space security and raises a number of issues for consideration. It side-steps the difficult task of defining space weapons or advocating a certain brand of arms control by prohibiting their placement in space. It rather focuses on how to use space in a peaceful manner that benefits mankind. Adoption of the EU Draft Code was, in part, triggered by China’s 2007 ASAT test which was immediately followed by a document entitled “Food For Thought on a Possible Comprehensive Code of Conduct for Space Objects” introduced by Italy in the Conference on Disarmament (CD) in March 2007.⁵ A number of gaps in existing TCBMs were highlighted as well as the need to strengthen adherence to, and implementation of, binding and non-binding space security-related obligations. The EU likewise recognised the importance of this initiative.

As referenced above, five space treaties and other existing soft law arrangements have already provided a solid foundation for guidelines and norms (e.g. the Outer Space Treaty, International Telecommunications Union, IADC Debris Mitigation Guidelines, etc.). Elements of these are included in the EU Draft Code of Conduct. However, as evident by the current dynamics of space-related initiatives, including the Inter-Agency Space Debris Coordination Committee and the Space Data Association, there is thirst for broader bottom-up support for space security. Guidance on more concrete TCBMs could help further advance formal initiatives like the EU Draft Code which could, in turn, bolster individual bottom-up initiatives.

Accordingly, the EU should focus on the following: support the “long term sustainability of space activities” initiative in the COPUOS;

⁵ Rathgeber, Wolfgang, Nina-Louisa Remuß, and Kai-Uwe Schrogl. “Space Security and the European Code of Conduct for Outer Space activities.” Disarmament Forum 4 (2009).

re-channel efforts placed on “prevention of an arms race in outer space” to promoting “responsible behaviour in space”; encourage European efforts to improve its SSA capabilities; promote further harmonisation of space object registration; and adopt measures to mitigate the risks of interference with space activities, including counterspace. Finally, it should continue to advance the EU Code of Conduct for Outer space activities, including identifying mechanisms for information sharing and clarifying the Code’s implementation process. This will help round-out existing and proposed space management initiatives and advance overall space security. These and other prospective understandings are elaborated on in the recommendations below.

Recommendations

General Measures

- *Raise Overall Awareness of Space Security Concerns.* This can be accomplished, in part, through organising intra- and inter-governmental expert groups that would conduct research, and propose viable solutions and/or policy options for decision-makers with regard to space debris, SSA/collision risk, interference, counterspace activities and other challenges. With a longer time horizon in mind, government-led education campaigns to recruit relevant experts on space security as well as provide funding for academic and non-governmental programmes to train future specialists would help build an adequately broad cadre of space security professionals. This expertise will be increasingly required in the period ahead. Ideally, space-faring nations would also seek to launch a global TCBM education campaign via different means (e.g. competitions, scholarships, media reports, research papers, etc.) to alert the larger community of relevant politicians to the urgency of this space portfolio.
- *Generate Greater Political Will to Cooperate.* Periodic “risk assessment” reports could be prepared that highlight the estimated impact of losing critical space infrastructure along the lines of the Marshall Institute and Space Enterprise Council’s *Day Without Space* series. Such reports could be presented to relevant governmental entities. A non-classified version of the reports could be shared with the general public to reinforce the global “space security awareness” campaign referenced above. Effective public diplomacy will be key to garnering the

kind of broad-based political support that will ultimately be needed to respond effectively to growing space security challenges.

- *Build Space TCBMs with Like-minded Partners.* Presently, some countries are calling for a treaty banning weapons in space or a treaty preventing an arms race in outer space. Others focus on promoting a code of conduct and the responsible use of space. Europe and the U.S. should continue to take the lead in promoting safe and sustainable space-related activities. The U.S. can advance this effort through its unmatched space capabilities, initially through comprehensive implementation of its SSA Data Sharing Program. Europe can, in turn, apply its long-standing experience in mediating stabilisation arrangements in multilateral bodies to advance specific TCBM measures for space. Space security can, thereby, be advanced faster as trust among space-faring nations could be more easily established. The EU and ESA could offer an overarching cooperative structure to coordinate the Member States (MS). Such a structure could embody advanced and funded SSA, Galileo and other architectures necessary for the implementation of bolder TCBMs in the future.
- *Strengthen Debris Mitigation Regime.* The IADC Guidelines were accepted by the COPUOS in June 2007 and endorsed by the UN General Assembly in February 2008 (UNGA Res. 62/217). The U.S., China, Russia, Japan, and Europe have in place debris mitigation guidelines. Given that these guidelines are voluntary and lack any verification or enforcement mechanisms, there is inconsistent compliance. Select UN members could be prompted to develop national standards for applying the IADC guidelines. Countries can also address the orbital debris concern through: unilateral actions (e.g. enforcement of space debris technical standards; fine non-compliance, etc.); bilateral actions (e.g. improved cooperation on mechanisms to exchange data and work toward interoperable SSA); and multilateral actions (e.g. encourage the UN to strengthen compliance requirements with its voluntary regime).
- *Improve Information Exchanges Related to Collision Avoidance.* Governments could seek to implement national standards, in part, through closer collaboration with industry which spearheaded establishment of a prototype multi-partner collision avoidance system. Data ex-

changes could be geared to improving space object databases; establishing common international data standards and data harmonisation; and cooperating on dissemination of orbital tracking information and formulating predictive modelling tools. Moreover, an institutionalised structure should be contemplated to facilitate smoother interface among Member States, the EU, industry and the Space Data Association.

- *TCBM Measures to Mitigate Interference with Space Activities.* This objective could be advanced via establishment of an International Interference Information Centre and similar structures for priority concerns. For example, strengthening of the Consultative Committee for Space Data Systems (CCSDS) offers an opportunity for more effective exchanges of data among space operators. This could, in turn, lead to greater government and commercial interoperability and mutual support. This kind of venue was proposed at the COPUOS in early 2010 in the context of its work on "Preliminary Reflections on Long-term Sustainability of Outer Space Activities".⁶
- *Avoid Space Becoming an Area of Conflict.* Countries could re-orient their attention from debates on prevention of an arms race in outer space (where little progress is expected in the near term) to individual declarations, gestures, and actions that make clear their peaceful intent in space. This could be accomplished through the timely sharing of space, national security and defence policies; bilateral visits during important, defence-related occasions, and even bilateral and multilateral military exercises testing the potential interoperability of deterrent space capabilities. The Schriever Wargame series could serve as a useful template for such military to military exchanges.
- *Improve Compliance with OST and Other Obligations.* Individual space-faring nations could strengthen oversight of non-governmental entities in space through stricter technical standards, licensing requirements and financial penalties in cases of non-compliance. Nations should request consultations when planning to conduct riskier activities in space. A

⁶ United Nations Committee on the Peaceful Uses of Outer Space. Item 14 on the draft provisional agenda of the Scientific and Technical Subcommittee entitled "Long-term sustainability of outer space activities: Preliminary reflections". UN Doc. A/AC.105/C.1/2010/CRP.3 of 8 Feb. 2010. Vienna: United Nations.



standing body should be considered to facilitate compliance with OST obligations. UN members could likewise be urged to seek sanctions for those nations that do not comply and/or endanger the space activities of other nations.

- *Financial Sanctions and Other Disciplinary Measures for Violators.* Nations with stakes in space could establish a system that could be employed on an ad hoc, case-by-case basis which could approve specific penalties for violators of the provisions of the OST and other space treaties and established principles for the safe and sustainable use of space. Such a system could be triggered by the abused party which could, in turn, “multinationalise” the response (if deemed meritorious), thereby making an escalatory spiral less likely. The disciplining measures could include financial sanctions and other tools, including curtailing access to space technology and related transfers.
- *Launch Dialogue on Implementation of Code of Conduct for Outer Space.* There have been a number of proposals concerning the need for a code of conduct to promote the responsible use of space. Specific guidelines, however, still need to be adopted multilaterally, beyond the successful adoption of the Space Debris Mitigation Guidelines. Areas that need close attention are international space situational awareness (SSA) for collision avoidance, radio-frequency interference prevention, and counterspace deterrence and penalties.
- *General Reciprocity Check List.* Create a list of individual steps that each state involved in a specific TCBM needs to follow before judging the character of a specific space activity to ensure the protection of national security space information and avoid unwarranted accusations of TCBM non-compliance.
- *Mutually Reinforcing Space Capabilities.* Certain countries possess a diversified and integrated technology base and advanced hardware that permit them to be largely self-sufficient in space. Other countries are self-sufficient only with regard to specific missions. The latter category of states relies on others to offset their shortfalls in order to fulfil their broader national requirements. A nation’s confidence can be undermined by their inability to participate in space activities without the assistance of others, uncertainty concerning access to necessary space technologies and the lack of space-

based information. Access to, and the benefits deriving from, space could be provided in exchange for cooperation and information-sharing relevant to space safety and security.

Specific Measures

- *Establish International Centre for Sharing SSA Data.* In order to mitigate collision risks, space operators need: awareness of near-term situations; orbital paths; and propagation ability. A new Data Centre could improve communications among operators as well as between governments and operators through the coordinated tracking of space objects.⁷ Such a centre could also coordinate collision avoidance activities by integrating various sources of SSA data, including ground- and space-based space surveillance networks (SSN), space observers⁸ and satellite operators. This concept has already been suggested⁹, and even partially implemented. A prototype Data Centre was established by seven major commercial owners and operators which regularly contribute data from some 120 satellites in GEO orbit.¹⁰ An important next step should be to identify and institutionalise the best means of coordinating, on an ongoing basis, with the Joint Space Operations Center (JSpOC) in the U.S. to take advantage of the overlapping of missions and value-added capabilities.

A fully functional Data Centre would: help augment existing U.S. TLE data with precision orbit data and manoeuvre plans;

⁷ During special activities, such as satellite relocations and transfer orbit missions, commercial operators exchange data with other commercial and government operators whose satellites are near or adjacent. The exchanged data include: latest location information, near-term manoeuvre plans, frequency and contact information for further follow-up. However, the existing system needs improvement due to structural flaws. These include: lack of agreed standards for TLE modeling; inadequate accuracy of TLE data for credible collision detection, and insufficient information flow concerning future satellite maneuvers. Specifically, there needs to be: an improved system of coordination for providing reliable information on future satellite maneuvers to prevent collision and allow for longer-term prediction of the orbital location of active satellites. This is especially urgent given the advances in propulsion systems and the almost-constant maneuvering of satellites to maintain their orbital position. (DalBello, Richard. “Commercial Efforts to Manage Space Environment.” Disarmament Forum 4 (2009).)

⁸ E.g. Independent Space Observes (ISO) and the International Laser Ranging Service (ILRS)

⁹ See, for example: Cox, Lee-Volker. “Avoiding Collisions in Space: Is it Time for an International Space Integration Center?” Carlisle Barracks: U.S. Army War College (2007).

¹⁰ DalBello, Richard. “Commercial Efforts to Manage Space Environment.” Disarmament Forum 4 (2009). 29.

facilitate sharing orbital element and/or ephemeris data in different formats by operators through conducting data conversion and reformatting tasks; establish common usage and terminology; develop unified operational protocols to handle routine and emergency situations; exchange protocols on a continuous basis; facilitate operator personnel contact information and establish a strict policy to secure the privacy of the data provided.

- *Institutionalise Guidelines for Information-Sharing on Interference Events.* Satellite or Earth-based terminal-originated satellite radiofrequency interference currently produces thousands of cases annually. Causes of radiofrequency interference include: faulty equipment; the proximity of equipment both on Earth and in space; and problems with the transfer mechanism of the signal. The operational challenges grow substantially with the increasing number of satellites (resulting in decreased physical separation between satellites), terminals on the ground (and their smaller size and mobility) and new suppliers, and the uneven quality of operators' skills.¹¹

Standardisation could be accomplished in the area of training and certification of relevant employees; a requirement for manufacturers of antenna to include the "carrier identification" (ID) technology in their equipment; and formalising and facilitating the information-sharing process concerning interference events. This could also involve creation of a RF interference database that could include satellite location and configuration information as well as reference emitters.¹² Commercial operators have already launched a project called the Satellite Operators' Radiofrequency Interference Initiative, but this initiative will eventually need to be more institutionalised.

- *Develop a Counterspace Crisis Management Centre.* Although space has not, thus far, experienced a large-scale, purposeful disruption or damage of one nation's space assets by another, this could well change in the period ahead. Jamming, directed energy weapons, ground-based and potentially space-based ASATs and other counterspace capabilities are, in some cases, already in place and ready for use. It would, therefore, be prudent to anticipate such future abuses or incidents by engaging in pre-crisis

planning, including the choreographed series of steps that would be taken in the event of a counterspace attack or incident. This would, in turn, require closer, and more institutionalised, government, industry and military-to-military coordination than has existed in the past and the identification of new avenues for rapid multilateral intervention. The SSA Centre could serve to house this function should a separate Counterspace Centre not be deemed desirable or practical.

EU Code of Conduct-Relevant TCBMs

- *Establish Joint Centre of European Organisations.* Civilian, commercial, and defence systems could be better integrated to provide improved and independent SSA capabilities that could be incorporated into an international structure. For example, the monitoring of close approaches and coordination of manoeuvres is not an adequately established practice of satellite operations due to cost, capability, willingness, or expertise. The EU and/or ESA could configure a collision avoidance notification service to: distribute space weather information; provide launch assistance; mediate manoeuvres among different entities; and provide assistance in emergencies or ambiguous situations. System of systems as envisioned for GEOSS could avoid the requirement for a large facility/staff.
- *Forge Cooperative Venue Among European Militaries.* Lack of coordination among European nations concerning the sharing of space capabilities and intelligence information from satellites leads not only to a reduced effectiveness of military missions, but also to an increased risk of the loss of lives and assets. Accordingly, a European Space Operations Centre, ideally in close coordination with a newly-established NATO structure, could: 1) multiply the effectiveness of individual nation's space assets; 2) create a formalised space security-oriented partnership between the EU/ESA and NATO; and 3) strengthen the existing trans-Atlantic partnership.
- *State Subscribers to EU Code of Conduct Should Lead By Example.* Smaller and emerging space-faring nations would benefit by standards set by an agreed EU Code of Conduct. EU Code of Conduct participants could also take the lead in implementing new space TCBMs as the evolution of more "congested, complex, and competitive" space unfolds.

¹¹ DalBello, Richard. "Commercial Efforts to Manage Space Environment." Disarmament Forum 4 (2009). 30.

¹² Ibid.



- *Utilise Special EU Negotiating Skills.* Europe can successfully serve as a trusted, skilful intermediary in space-related disputes, and even conflicts, among other space powers (e.g. China or Russia and the U.S.). European diplomats have honed such mediation skills for, in some cases, centuries, and have a reputation of calm creativity in bringing other parties to the table and defusing what might otherwise be an escalatory spiral of retaliatory steps in the event of a deliberate or inadvertent “incident”. Establishment of a “Space Mediation Board” of leading European space experts in various dimensions of the space security portfolio could become an important re-

source for global space-faring nations as well as those that aspire to this status.

- *Promote Further Harmonisation of Space Object Registration.* Europe could undertake an initiative to bolster the effectiveness and harmonisation of registration practices based on the Registration Convention and UNGA Resolution 62/101. The Resolution, in part, requires more detailed disclosure in the registration process, leading to greater overall transparency. This particular provision, however, would benefit from a coordinated political intervention aimed at universal implementation.¹³

¹³ The UNOOSA maintains two separate, but complementary, registers on objects launched into outer space. One register collects information provided by States in accordance with UNGA 1721 B (XVI) of Dec 1961, which does not specify detailed information to be provided. The second register collects information provided by States to the Registration Convention. Neither of the registers requires provision of the GSO position. The Registration Convention does not have provision for the “change of ownership” of a space object. The GSO positions are mostly registered with the ITU. As of January 2005, only sixteen out of 45 parties to the Registration Convention had informed the Secretary-General of the establishment of national registers (in accordance with Article II). Multiple launching states, as well as transfer of ownership from one commercial entity to another also complicates the situation. Other issues of registering include: more than one identifier for a space object, different orbital parameters, different time zones, etc. (Schrogl, Kai-Uwe and Niklas Hedman.”The UN General Assembly Resolution 62/101 of 17 December 2007 on ‘Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects’.” *Journal of Space Law*, 34:1 (2008) 145 – 151.)

1. Introduction

Space assets in the twenty-first century offer the world huge benefits unimaginable just a few decades ago. These space-related benefits are accompanied by, in a manner similar to other cutting-edge areas, significant risks manifested, in part, by growing anxiety about the safety and security of these assets, as well as protecting unfettered access to space. Among the harsh realities facing stewards of space today are dangerous orbital debris and thus the potential of destructive collisions, the growing saturation of the radio-frequency spectrum, the crowding of satellites in geostationary (GEO) orbit, as well as the ever-present threat of purposeful disruption. These and a number of other challenges call for the serious involvement of all space-faring and other countries in managing and mitigating these downside risks.

Unlike the Cold War period, when adversaries and threats were more clearly defined and diplomacy had an urgent quality (especially in the field of nuclear weapons and missile proliferation), today's space threats appear less compelling than they really are. Accordingly, a number of countries are reluctant to sign up to legally-binding treaties to address these security risks, at least at this time. Smaller steps, however, are possible, such as transparency and confidence-building measures (TCBMs). At the same time, assured access to space-based assets and services cannot be accomplished on a unilateral basis, and requires international cooperation.

In reviewing transparency and confidence-building measures, it is useful to define what is meant by TCBMs. Transparency is an integral part of confidence-building. Accordingly, transparency will be defined for the purpose of this report as "the degree of openness in conveying information and a device of strategic negotiations signalling the trustworthiness of the actor in negotiations".¹⁴ The level of transparency is a policy choice and given the differing policy goals of various nations, constructing acceptable transparency measures is particularly challenging, even when many modern technologies, including space imagery, increase transparency regardless of the policy choices of states. As Carolyn Ball

points out, information availability in itself does not constitute transparency.¹⁵ Transparency is realised only if the intentions of a government are known, in part, through understanding the interaction of key policy-makers in that government. Non-state actors represent a special problem, likely requiring an ad hoc, case by case approach to keeping them in compliance with accepted behavioural norms.

Accompanying transparency, there are a number of CBMs that are generally recognised, including: informational measures; consultative modalities; notification requirements; constraint mechanisms; and access measures. Informational measures most often involve making public, or to other states, information about a government's national security policies, military capabilities, arms imports and exports, defence budgets etc. Consultative modalities seek to facilitate dialogue between nations to reduce tensions and the risk of armed conflict by instituting preventive actions. Notification requirements are generally employed to provide information concerning a state's plans to conduct certain military tests or activities. Constraint mechanisms discourage or prohibit certain types of activity. Finally, access measures allow states to monitor each other's actions as well as verify compliance with constraint-oriented CBMs (e.g. on-site inspections of each other's military installations)¹⁶. James Marquardt compares the process of confidence-building to "climbing the rungs of a ladder", the higher you climb the greater confidence is produced.¹⁷ Put another way, implementing TCBMs is an incremental process.¹⁸

¹⁵ Ibid, 297.

¹⁶ Marquardt, James J. "Transparency and Security Competition: Open Skies and America's Cold War Statecraft, 1948–1960." *Journal of Cold War Studies* 9.1 (2007): 61.

¹⁷ Marquardt, James J. "Transparency and Security Competition: Open Skies and America's Cold War Statecraft, 1948–1960." *Journal of Cold War Studies* 9.1 (2007): 60–61.

¹⁸ Michael O'Hanlon, for example, includes CBMs as one of three categories of arms control. He identifies CBMs as mechanisms that help "reduce tensions, improve communications, calm nerves, and build safety mechanisms into the military use of outer space". (O'Hanlon, Michael E. "Arms Control In Space." *Neither Star Wars Nor Sanctuary: Constraining the Military Uses of Space*. The Brookings Institution: Washington DC, 2004. 113–114.)

¹⁴ Ball, Carolyn. "What is Transparency?" *Public Integrity* 11.4 (2009): 297.



There has been a convergence of interests in Europe, the U.S. and Asia with regard to engagement in finding multilateral solutions to global challenges. As a result, global political atmospherics are particularly well-suited to attempting bolder steps in the TCBM portfolio as well as the crafting of norms concerning international behaviour and operations in space. Moreover, as space becomes even more of a beehive of activity, technical and other issues will continue to surface that require policy responses and the political will to make tough decisions, both at multilateral and national levels. Should terrestrial political tensions rise, the probability of implementing meaningful TCBMs will likely decline. Accordingly, the time to persuade nations of the merits of TCBMs is now.

One of the biggest hurdles to TCBM adoption and implementation is their credibility historically. TCBMs have been employed for decades in nuclear arms control, missile non-proliferation and other arenas, and created generations of sceptics, especially stemming from those occasions when it was perceived that significant concessions were made for little or nothing in return from the targeted parties. Despite this uneven track record, the global space community appears to recognise the need to redouble its efforts to forge achievable and pragmatic TCBMs. This patient, steady approach is difficult as politicians often seek more immediate, tangible results from national gestures of cooperation. Engaging in TCBMs can be a politically treacherous path, especially in those instances when each step has to be continuously calibrated. The abuse of TCBMs can also leave politicians politically exposed. Due to this and numerous other concerns, a framework that provides for greater reciprocity based, in part, on an individually-tailored set of milestones to judge TCBM effectiveness, would be useful. There is also a requirement for penalties in the event of non-compliance with the terms of future agreements.

Acknowledging the limitations of TCBMs, they will almost certainly play an essential role in securing space for the balance of this century and beyond. TCBM compliance will inevitably need to be accompanied by a verification regime through improved space situational awareness (SSA) and enforcement measures. These are increasingly essential prerequisites in the complex, high-velocity environment of the 21st century where mutual trust is seemingly becoming an ever scarcer commodity. TCBMs are also important policy tools in the broader debate on space security as they generally accompany processes to govern access to, and the use of, space.

This study seeks to address, among others, the following questions: What lessons can be drawn from “terrestrial” TCBMs? Do the TCBMs in the existing framework for space activities provide a solid basis for advancing space safety and security? Which TCBMs are most urgent? How can international momentum behind TCBMs best be generated? Are there opportunities for new cooperative initiatives based on agreed TCBMs, like the EU Draft Code of Conduct for Outer Space Activities?

To address the use of TCBMs for space, information and research materials were collected through a number of means including in-house, open source research and expert interviews via telephone and in-person. As part of this undertaking, the European Space Policy Institute (ESPI) co-organised, together with the College of Law at the University of Nebraska, a conference entitled “Space Security and Space Tourism: Challenges To, and Transatlantic Perspectives On, Governance”. ESPI was responsible for preparing the first day of the conference dedicated to “*Transparency and Confidence Building Measures: Alternative Vehicles to Advance Space Security*”. The conference was held in Lincoln, Nebraska, on 6–7 May 2010. The conference panels discussed such topics as current and emerging challenges in space; terrestrial TCBMs as a guide to understanding the politically possible in space; and challenges associated with reaching consensus on vehicles to strengthen space security.

The research further involved a number of interviews that were conducted with experts in the field of nuclear proliferation, arms control and space security. A comparative approach was employed to understand the challenges associated with implementing TCBMs for space. Different dimensions of TCBMs were likewise examined. Particular attention was paid to those experts familiar with past multilateral cooperative efforts in these fields to gain valuable insights concerning the technical and practical issues that surfaced during the effort to implement selected TCBM’s. The interviews contributed significantly to illuminating this complex issue area.

The study is divided into six chapters. An analysis of terrestrial TCBMs, as well as different implementation modalities is provided in Chapter 2. Space-related TCBMs and proposed space security management regimes are then examined in Chapter 3 to highlight the advantages and shortcomings of each. This section also provides a narrowed-down review of potential TCBMs. In this connection, the draft EU Code of Conduct for Outer Space Activities is evaluated in greater detail in Chapter 4 as a possibly suitable model for

internationally-supportable space security management.

Finally, in Chapters 5 and 6 conclusions and recommendations are offered, certain of which concentrate on the most viable ways of achieving the kind of transparency, incentives, disincentives and compliance necessary to deter action by space-faring nations that could impede or deny free access to, and safe use of, space. The importance of having TCBMs in place prior to “incidents” is emphasised. In this context, Europe’s long-standing diplomatic skills are also cited, given that credible intermediaries will be a central element in the successful application of global, regional and technical TCBMs. Effectively communicating the benefits of broad support for TCBM implementation is among the recommendations.

The recommendations address a number of the issue areas described above. They also seek to provide elements of a more comprehensive infrastructure for the systematic evaluation and management of various dimensions of the space security portfolio. In the past, space security considerations have largely been dealt with on an individual, ad hoc basis (e.g. SSA, orbital debris etc.) as opposed to being integrated into broader understandings and accords. “Space security” represents such an umbrella concept that warrants being regarded as an independent field within overall space policy. Similarly, TCBMs associated with this field have tended to be stove-piped when they are most often mutually reinforcing when examined in a more holistic fashion.



2. Terrestrial TCBMs: Lessons Learned

Some experts argue that negotiations, including those related to confidence-building measures, generally involve substantive concessions that countries commit to in exchange for a prospect of improved stability. Accordingly, the level of trust is less important than the extent of delivered commitments¹⁹. Moreover, transparency can result from upgraded technological capabilities. For example, high-resolution commercial remote sensing represents an important new information resource and can compromise certain, otherwise secret military operations. Such transparency, however, could also be “a double-edged sword” potentially encouraging offensive actions and preemption.²⁰ Accordingly, any security-related cooperative regime involving TCBMs, including those that are non-binding, has to be carefully weighed and include the compliance by all relevant parties. Ensuring compliance is an interactive exercise where all parties play a role and none of the parties can be completely controlled. Through TCBMs and mechanisms for their implementation, military and political leaders can create a knowledge which can help anticipate the behaviour of other actors.

2.1 TCBMs in Arms Control and Nonproliferation Agreements

Arms control accords primarily seek to advance global security by managing and/or reducing the number of weapons produced and/or deployed, and their proliferation to other state or non-state actors. To be sure, some doubt the effectiveness of such agreements to restrain potential adversaries without unduly constraining their own military capabilities. Most see them as a means of contributing to stability, predictability and a reduced risk of conflict.

Nuclear and missile nonproliferation efforts are closely connected as many countries seek both nuclear and missile-delivery capabilities. International non-proliferation regimes seek to reduce the intentional, unauthorised diversion of commercial technologies, equipment, and expertise for military purposes. In this connection, the conversion of space launch vehicles (SLV) into long-range ballistic missiles is more straightforward than working with nuclear weapon technologies.²¹

Arms control and nonproliferation initiatives can be divided into several categories. In the course of the past four decades, a number of nuclear and other weapons reduction and nonproliferation initiatives have been undertaken. These initiatives have involved treaties and agreements negotiated on bilateral basis; multilateral nuclear-related treaties; multilateral nuclear mechanisms; non-nuclear-related structures to control conventional weapon technologies; weapons-elimination initiatives; and transparency and confidence-building proposals (see Table 1 below).

2.1.1 Cold War Arms Control

Missile-Related Arms Control

The doctrine of mutually assured destruction (MAD), which gained official endorsement during the Cold War, prevented an ICBM attack by, in effect, a “balance of terror”.²² With increasing levels of ICBM capabilities, the U.S. and the Soviet Union eventually perceived the need to engage in limiting their deployment, and began the Strategic Arms Limitation Talks (SALT I). SALT I resulted in the Anti-Ballistic Missile Treaty (ABM) and the Interim Agreement on strategic offensive arms.

¹⁹ Fitzgerald, Keith. “Don’t Trust...Negotiate.” Conference Paper. International Studies Association: 2006 Annual Meeting.

²⁰ Hays, Peter L., James M. Smith, Alan R. Van Tassel, and Guy M. Walsh. “Spacepower For a New Millennium: Examining Current U.S. Capabilities and Policies.” *Spacepower for a New Millennium: Space and U.S. National Security*. McGraw-Hill, 2000. 13.

²¹ Zaborski, Victor. “Missile Proliferation Risks of International Space Cooperation.” *World Affairs* 165.4 (2003): 185.

²² “Missile Defense, Space Relationship & the Twenty-First Century.” Cambridge, Washington: The Institute For Foreign Policy Analysis, 2009. 54.

Cold War Period	Bilateral nuclear-related treaties and agreements	Strategic Arms Limitation Talks (SALT I: Anti-Ballistic Missile Treaty and Interim Agreement) and SALT II; Intermediate-Range Nuclear Forces (INF) Treaty
	Multilateral nuclear testing-related treaties and agreements	Limited (Partial) Test Ban treaty (LTBT/PTBT); Nuclear Non-Proliferation Treaty (NPT); Threshold Test Ban Treaty (TTBT); Peaceful Nuclear Explosions Treaty; Comprehensive Test Ban Treaty (CTBT)
	Other multilateral nuclear-related mechanisms	International Atomic Energy Agency (IAEA); Nuclear-Weapons-Free-Zones (NWFZ); Nuclear Suppliers Group (NSG)
	Transparency and confidence-building measures	Open Skies Treaty;
	Agreement with detailed verification mechanisms, including on-site inspections	Conventional Forces in Europe (CFE) Treaty
Post-Cold War Nuclear-related Treaties and Other Proposals		Strategic Arms Reduction Treaty (START) I, START II; Strategic Offensive Reductions Treaty (SORT, known as Moscow Treaty); New START; Fissile Material Cut-Off Treaty (FMCT); International Convention for the Suppression of Acts of Nuclear Terrorism
Conventional Weapons Technology Controls		Missile Technology Control Regime (MTCR); The Hague Code of Conduct; The Wassenaar Agreement
Weapons-Elimination Efforts		Chemical Weapons Convention (CWC); Biological Weapons Convention (BWC); Ottawa Treaty

Table 1: Arms Control and Non-proliferation Initiatives.

The ABM Treaty banned the testing and deployment of space-based, sea-based, or air-based ABM systems and components. Article V of the ABM Treaty provided: "1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based."²³ It also imposed a ban on ASATs by stating that "each Party undertakes not to interfere with the national technical means of verification of the other Party". Signing the ABM Treaty, however, did not stop the deployment of a large number of missiles on the Soviet side and by 1982, Washington and Moscow again relied more on their respective offensive capabilities. By that time, other countries, including China, were developing ballistic missile technologies, giv-

²³ "Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems", <<http://www.state.gov/www/global/arms/treaties/abm/abm2.html>>

ing rise to increased proliferation concerns.²⁴ The Bush Administration was especially alert to potential missile threats, including those involving space, and the events of 11 September 2001 led to an announcement by the Bush Administration in December 2001 of the U.S. withdrawal from the ABM Treaty within a six month period.²⁵ Despite its non-enforceability, the ABM Treaty pioneered the effort to cooperate and restraint such delivery systems.²⁶ The Interim Agreement imposed a halt on the number of ICBM and SLBM launchers the U.S. and USSR could deploy.²⁷

Both the ABM Treaty and SALT I Interim Agreement called for non-interference with

²⁴ "Missile Defense, Space Relationship & the Twenty-First Century." Cambridge, Washington: The Institute For Foreign Policy Analysis, 2009. 54.

²⁵ Ibid.: 64.

²⁶ Moltz, James Clay. "The Emergence of Cooperative Restraint." *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 174.

²⁷ At the time, the U.S. had 1,054 and the USSR had 1,618 ICBM launchers.



national technical means (NTM) of verification and thus legally bound both countries to constraints in space previously existing only in non-binding form. These treaties linked space, for treaty verification purposes, with implementation of U.S.-Soviet nuclear reduction accords.²⁸ These agreements were followed by a seven-year long negotiation, concluded in Vienna in 1979, by the signing of the Strategic Arms Limitation Treaty (SALT II). It limited the number of strategic nuclear delivery vehicles (ICBMs, SLBMs, and heavy bombers), MIRV systems, and strategic offensive arms. It likewise imposed a ban on construction of new land-based ICBM launchers and incorporated verification provisions. Due mainly to a number of unresolved issues, including the Soviet Backfire bomber and cruise missiles, and Moscow's invasion of Afghanistan, the Strategic Arms Limitation Treaty (SALT II) was never ratified. At the same time, both parties declared a political commitment to observe the SALT II treaty on the condition of "mutual restraint".

Proposed SALT II TCBMs included: advance notification of certain ICBM test launches; an agreed database for systems included in SALT-limited categories; agreement not to interfere with each other's national technical means of verification; not to use deliberate concealment measures that would impede verification by NTM of compliance with the agreement; and not to engage in deliberate denial of telemetric information (e.g. through encryption) to allow monitoring (i.e. verification of compliance) of the Treaty.²⁹

The 1987 INF Treaty, signed during President Reagan's second term, obliged the U.S. and Soviet Union to eliminate and permanently abandon all their intermediate-range and shorter-range nuclear-armed ballistic missiles and ground-launched cruise missiles with ranges of 500–5,500 km, as well as the launchers associated with controlled missiles. The INF Treaty applied to all land-based missiles regardless of their equipment or configuration. The INF Treaty was perceived as a great stride forward in arms control and as a model for subsequent arms control treaties such as START I and Conventional Forces of Europe Treaty (CFE Treaty). It represented the agreed destruction of an entire category of nuclear weapons and reinforced strong

verification and data exchange mechanisms.³⁰

The verification protocol certified reductions through national technical means (i.e. satellite observations) and on-site inspections. In Article XII, the parties agreed not to interfere with the NTM of the other Party and engage in concealment measures that impeded verifications by NTMs. The inspections were divided into the following:

- baseline inspections (to verify data exchanged on Treaty limited items)
- closeout inspections (to verify termination of INF-related activities)
- elimination inspections (to confirm destruction of missiles, launchers and related equipment)
- short-notice inspections (up to 20 short-notice inspections per year at sites designated by the Treaty during the first three years of the treaty implementation, and 15 such inspections annually in the following five years)
- continuous monitoring inspections at the portal and perimeters of a former missile production facility in each country (only at two facilities: Votkins, Russia and Magna, Utah)³¹

In 2007, Russia threatened to withdraw from the INF Treaty, partially due to U.S. plans to deploy a "Third Site" missile defence system in Central Europe. Since that time, continuous efforts have been made by Russia to globalise the INF Treaty.³²

After the end of the Cold war, there were opportunities for reducing defence costs and for building a more stable footing for relations between Washington and Moscow. In July 1991, the bilateral Strategic Arms Reduction Treaty (START) was announced. It called for specific limits on launchers and the first physical reduction in U.S. and Soviet strategic nuclear weapons ever agreed too, with verifiable cuts to 6,000 warheads within ten years.³³

The 1987 Intermediate-Range Nuclear Forces (INF) Treaty, became the first nuclear arms

²⁸ Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 170.

²⁹ Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Strategic Offensive Arms. The State Department web site. 19 July 2010. <<http://www.state.gov/www/global/arms/treaties/salt2-1.html>>.

³⁰ The warheads and guidance systems of the missiles needed not be destroyed. 2,692 short-, medium-, and intermediate-range missiles had been destroyed by June 1991.

³¹ The U.S. continued to operate its site at Russia's Votkinsk Missile Assembly facility under the 1991 START Treaty.

³² "INF Treaty." 28 Apr. 2010. Inventory of International Nonproliferation Organizations and Regimes. Center for Nonproliferation Studies. 20 Jul. 2010. <http://www.nti.org/e_research/official_docs/inventory/pdfs/inf.pdf>.

³³ Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 224.

control agreement to actually reduce nuclear arms, as did the 1991 START Agreement, negotiated for almost a decade and signed by U.S. President George H.W. Bush and Soviet President Mikhail Gorbachev. Neither the INF nor START obligates parties to destroy warheads. The START agreement obliged the Soviet Union to destroy more than 3,000 ballistic missiles, 45 atomic submarines and more than 65 strategic bombers. The U.S. destroyed more than 3,000 missiles, and a significant number of launchers and bombers.³⁴ Later, in May 2002, Presidents George W. Bush and Vladimir Putin signed the Moscow Treaty on Strategic Offensive Reductions. It supplemented the 1991 START agreement and called for further reductions in both warheads and delivery systems by two-thirds (warheads to between 1,700 and 2,200 by December 2012). Each side was to determine its “strategic forces”, i.e. delivery systems, consistent with the reduced number of warheads. It likewise established a bilateral Implementation Commission to meet twice a year to discuss issues that might arise.

A new Strategic Arms Limitation Agreement was signed by Presidents Barack Obama and Dmitri Medvedev in April 2010, replacing the expired 1991 START agreement, the 2002 Moscow Treaty, and a non-binding agreement of 2009. The 2010 agreement reduced the number of deployed nuclear warheads to 1,550 and the number of delivery vehicles (ICBMs, submarines and bombers) to 800 (down from 1,600 under the START agreement). The new totals of nuclear warheads represented a 74% reduction from the 1991 START treaty and a 30% reduction from the 2002 Moscow Treaty limits. An inspection programme was also included. This new accord still needs ratification by legislators in both countries. The new treaty covers only strategic nuclear weapons, not “tactical” nuclear weapons or strategic warheads held in reserve.³⁵

With regard to verification, the 2010 agreement includes the following elements:

- On-site inspections and exhibitions
- Data exchanges
- Notification of changes related to strategic offensive arms and facilities covered by the treaty
- Provisions to facilitate the use of national technical means for treaty monitoring
- “Exchange of telemetry” to increase transparency and build confidence

³⁴ “Strategic Arms Limitation Talks 2009.” Background Information Summaries. Great Neck Publishing. 1.

³⁵ “Strategic Arms Limitation Agreement 2010.” Background Information Summaries. Great Neck Publishing.

Nuclear-Related Arms Control

The 1968 Nuclear Non-Proliferation treaty (NPT), involving 189 states as signatories, obligates the five acknowledged nuclear-weapon states (NWS) not to transfer nuclear weapons, other nuclear explosive devices and/or their technology to non-nuclear-weapon states (NNWS) as well as work toward disarmament. NNWS are, therefore, not permitted to receive, acquire, or manufacture nuclear weapons or other nuclear explosive devices. The UN Security Council Resolution (UNSCR) 255 of June 1968 on security assurances related to NPT’s NNWS accompanied the NPT.³⁶ In the Nuclear Posture Review (NPR) of April 2010, the traditional U.S. policy of “strategic ambiguity” that refused to rule out the use of nuclear weapons against NNWS in response to biological or chemical weapons attacks (including from NPT member states), was changed and instead declared that it would not use nuclear weapons against NNWS that are good members of the NPT.³⁷ All NNWS nuclear material for peaceful activities must be maintained under IAEA safeguards.

The IAEA safeguard system is underpinned by transparency-oriented measures, among them: data collection; periodic inspections of facilities, both declared and undeclared, within which weapons-related activities are suspected.³⁸ NPT members also have an obligation to declare and submit all nuclear materials they possess to regular IAEA inspections. In addition to inspections, the IAEA has established its own satellite data interpretation capabilities, marking the first use of satellite data by the UN. Some NPT non-members, which are IAEA members, allow inspections as well, but only in select nuclear facilities.

The revelations by the IAEA and the UN Special Commission on Iraq (UNSCOM) of Iraq’s covert nuclear weapons programme in 1991, previously undetected by the annual IAEA inspections of declared facilities, was a demonstration of the NPT’s shortcomings. The Treaty does not possess (unlike, for example, the Chemical Weapons Convention or the Comprehensive Test Ban Treaty), a built-in

³⁶ “Treaty on the Non-Proliferation of Nuclear Weapons.” 11 Jan. 2010. Inventory of International Nonproliferation Organizations and Regimes. Center for Nonproliferation Studies. 1–2. 05 Jul. 2010. <http://www.nti.org/e_research/official_docs/inventory/pdfs/npt.pdf>.

³⁷ “U.S. ‘Negative Security Assurances’ at a Glance.” Arms Control Association.

<<http://www.armscontrol.org/factsheets/negsec>>.

³⁸ The IAEA, established in 1957, has two primary functions: to assist nations in their peaceful nuclear programmes and to prevent nuclear materials to be diverted to nuclear weapons uses.



mechanism for noncompliance. Verification of NNWS compliance is only conducted via the IAEA safeguard regime. Noncompliance is to be reported to the UN Security Council and General Assembly by the IAEA Board. The UN bodies can then impose specific penalties, if warranted. The most prominent countries that have challenged the NPT are Iraq, North Korea and Iran.

Article VII of the NPT (reaffirmed by the UN General Assembly in 1975) describes the right to create nuclear weapons free zones (NWFZ) designated to be free of manufacturing, acquiring, testing, or possessing nuclear weapons, with the exception of nuclear energy for peaceful purposes. There are five NWFZ established by individual treaties.³⁹ Three of these treaties, however, include provisions allowing for the transfer of NW through these zones. Each NWFZ treaty includes so-called negative security assurances, a legally-binding protocol calling upon the NWS to respect the status of the zones and not to use, or threaten to use, nuclear weapons against treaty-participating parties. The NWS, however, reserved the right to respond with various options in case there are certain developments in these countries. A protocol for a Southeast Asian zone, for example, was not signed by any NWS due to fear of interfering with the right of their ships and aircraft to move freely in international waters and airspace.⁴⁰

The NPT did not provide for the production of fissile material usable for nuclear weapons and, accordingly, a fissile material production ban was proposed by the U.S. and has been negotiated, so far unsuccessfully, at the Conference on Disarmament (CD). In 1995, the CD agreed on so-called "Shannon Mandate", seen by some as the basis for future negotiations on the Fissile Material Production Cutoff Treaty (FMCT). However, no negotiations, as yet, have begun.

Other nuclear nonproliferation efforts include the Nuclear Suppliers Group (NSG), the Convention on the Physical Protection of Nuclear Material and International Convention for the Suppression of Acts of Nuclear Terrorism (also known as the Nuclear Terrorism Convention). These mechanisms are of limited effectiveness as there is a distinct lack of

enforcement and verification mechanisms in place. This is evidenced, for example, by the NSG in connection with the A.Q. Khan network and by the past WMD developments in North Korea and Iran.

The negotiations on The Nuclear Terrorism Convention, although covering only acts by individuals not states, represent an interesting case study to compare with space-related arms control proposals. This Convention was preceded by an eight-year discussion concerning a draft treaty proposed by Russia in 1997, which came to a deadlock when discussing a definition of terrorism and the issue of nuclear weapons use by states. The Convention provides definitions of unlawful possession and use of radioactive or nuclear material/devices, and the use or damage to nuclear facilities. Accordingly, the focus was placed on behaviour, as does the draft EU Code of Conduct for Outer Space Activities.

Other informal cooperative activities seeking to address nuclear weapons include: the Global Threat Reduction Initiative (GTRI); the Proliferation Security Initiative (PSI); and unilateral and multilateral sanctions. With regard to testing of nuclear weapons, a number of Treaties exist, including the 1953 Limited Test Ban Treaty (LTBT), also known as the Partial Test Ban Treaty (PTBT); the 1974 Threshold Test Ban Treaty (TTBT); the 1976 Peaceful Nuclear Explosions Treaty; and the 1996 Comprehensive Test Ban Treaty (CTBT).⁴¹

2.1.2 Multilateral Accords

Confidence-Building Mechanisms

The precedent often cited in researching past TCBMs is the Cold War's Open Skies Treaty, a proposal for establishing a comprehensive system of mutual aerial observation introduced by U.S. President Dwight Eisenhower to the Soviet Union in 1955. CBMs were also put forward in the 1990 Treaty on Conventional Armed Forces in Europe (CFE Treaty) and in the Vienna Documents.

Open Skies Treaty

Open Skies was designed to use "openness" concerning military activities as a CBM. It was preceded by a series of U.S. proposals

³⁹ Four of these five zones are in the Southern Hemisphere. The regions under NWFZ agreements include: Latin America (the 1967 Treaty of Tlatelolco), the South Pacific (the 1985 Treaty of Rarotonga), Southeast Asia (the 1995 Treaty of Bangkok) Africa (the 1996 Treaty of Pelindaba) and Central Asia (the 2006 Treaty of Semipalatinsk).

⁴⁰ In addition to NWFZ, there are other treaties that ban the deployment of nuclear weapons in Antarctica, Mongolia, on the seabed, and in outer space.

⁴¹ The CTBT goes beyond LTBT in saying that no state that is party to the treaty should test nuclear weapons. This treaty, opened for signature in 1996, has not yet entered into force. As of January 2010, 182 nations had signed the CTBT and 151 had ratified it. Three nuclear weapon states, i.e. India, North Korea and Pakistan, have not signed the treaty. Among others, China, Iran, Israel and the U.S. have not ratified the Treaty.

beginning in the late 1940's to achieve greater disclosure by Moscow about their foreign and defence policy. Some argue that it was not a trust-promoting mechanism, but rather a political initiative countering Moscow's efforts to institute "general and complete disarmament" with virtually no verification provisions. James Marquardt labelled it "coercive transparency" in U.S. Cold War relations with the Soviet Union.⁴² Although it did not materialise at the time, it was able to generate a dialogue on security cooperation between the two superpowers and both sides demonstrated some willingness to compromise.

President George H.W. Bush revived the proposal in a more modest form in May 1989. By that time, aircraft intelligence-gathering was superseded by remote sensing satellites. The need for transparency and confidence-building in Europe in the post-Cold War period were seen as necessary tools to reduce the chances of military miscalculations. The Treaty was signed in March 1992 by 22 European states, the U.S., and Canada (entering into force in January 2002 with the ratification by Russia and Belarus). It permitted unarmed aircraft to conduct flights over the territories of both countries. More than 500 missions were conducted since the first official overflight in 2002.⁴³

Provisions of the Treaty included:

- Overflight is permitted over any area except where safety is a concern (e.g. nuclear power plants)
- The aircraft and sensors can be provided both by the conducting and observing country
- Costs can be shared by nations conducting the overflight, including using the equipment of others
- Each nation is assigned an annual quota of overflights

The confidence-building measures embodied are:

- Permitted equipment allows the nations to collect basic information on military forces and activities, but little technical intelligence (i.e. limited resolution capability)
- Observation flight produces two sets of data: for observing and the observed nation

⁴² Marquardt, James J. "Transparency and Security Competition: Open Skies and America's Cold War Statecraft, 1948–1960." *Journal of Cold War Studies* 9.1 (2007): 57.

⁴³ "The Open Skies Treaty at a Glance." Arms Control Association. 27 July 2010. <<http://www.armscontrol.org/factsheets/openskies>>.

- Other Treaty members can purchase copies of the data

Commercially available satellite remote sensing technologies and resolution are now far more advanced than those specified by the Treaty. Although the Treaty's purpose is to build confidence, not gather intelligence information, the relevance of this agreement in its current form remains questionable.

The 1990 Treaty on Conventional Armed Forces in Europe (CFE Treaty)

The CFE Treaty is an elaborate conventional arms control regime and has been called a "cornerstone of European security". The Treaty provides the only legally binding and verifying mechanism limiting the size of conventional ground and air forces that State Parties may maintain within the Treaty's area of application (Atlantic to the Urals). The original agreement placed ceilings on major categories of heavy conventional armaments and equipment of the NATO and Warsaw Pact Treaty members.⁴⁴ This development was preceded by fruitless talks on East-West relations officially initiated at the Conference on Security and Cooperation in Europe in Helsinki in 1973.

The product of these talks was the Helsinki Accord that included, among other items, agreement on notification of military manoeuvres of more than 25,000 troops within about 150 miles of any border.⁴⁵ Later in Stockholm in 1986, members agreed to on-site inspections and other confidence-building measures (i.e. prior notification on, and observation of, certain military activities; an annual list (calendar) of planned activities; constraining provision on the activities of troops; and compliance and verification measures).⁴⁶

The compliance and verification CBM has proved especially controversial. Each state could request an inspection by ground or air when compliance with the agreement is in doubt. Such inspections could be conducted within 36 hours of the request and terminated after 48 hours. The state did not have to accept more than three inspections per year and a maximum of one inspection per state. It was likewise asserted that states

⁴⁴ Measures were adopted to counterbalance the Flank Agreement, including the enhancement of reporting requirements and increasing of inspection rights in the zone.

⁴⁵ The declaration also included pledges on the inviolability of frontiers, respect for human rights and fundamental freedoms, freer dissemination of information, and respect for political, social, economic and cultural system that each member chooses.

⁴⁶ "Summit in Europe: The Security Conference: What It Is, What it Has Accomplished." *New York Times*, 19 Nov. 1990: 6.



belonging to the same alliance cannot inspect one another. It was not clear, however, how NATO and neutral and nonaligned states would share a quota for a Warsaw pact country.⁴⁷

After the end of the Cold War, the Agreement on Adaptation of the CFE Treaty opened the regime to the new states and this Agreement was reinforced by political commitments at the 1999 Istanbul summit of the Organization for Security and Cooperation in Europe (OSCE), the so-called Istanbul commitments.⁴⁸ The CFE regime is seconded by the 1999 Vienna Document on CSBMs described below.

The CFE Treaty provides for:

- Detailed data exchanges on equipment, force structure, and training manoeuvres;
- Specific procedures for the destruction or redistribution of excess equipment;
- Verification of compliance through on-site inspections

In 2007, Russia suspended its participation in the CFE. Reasons included: the pressure of members for Russia to comply with the 1999 Istanbul Commitments and withdraw its troops and treaty-limited equipment (TLE) in Georgia by 2007⁴⁹, the 1996 Flank Agreement that set limits on permitted holdings of TLE in flank zones in northern and south-eastern Europe; and the proposed deployment of a U.S. ground-based missile defence system in the Czech Republic and Poland. The Russian incursion in Georgia in August 2008 witnessed the violation of principles contained in the OSCE documents and the preamble of the CFE Treaty.⁵⁰ These developments demonstrate a wide spectrum of strategic, military, political and other issues dividing the

OSCE states and the stalemate status of this regime.⁵¹

Confidence- and Security-Building Measures (CSBM)

As referenced earlier, the Helsinki Final Act of 1975 introduced confidence-building measures to “increase predictability through greater openness and transparency”. The confidence- and security-building measures (CSBM) were later adopted in the Stockholm Document in 1986, as well as in four subsequent Vienna Documents (in 1990, 1992, 1994, and 1999).⁵² The purpose of the 1999 Vienna Document of The Negotiations on Confidence- and Security-Building Measures (CSBM) was to increase security and achieve at least partial disarmament among the participating countries. These CSBMs offer a number of transparency measures concerning the participating countries’ militaries. They are introduced below in table 2.

Conventional Weapons Technology Controls

Most of the multilateral efforts directed at missile proliferation are under the framework of the UN. Some, like the Missile Technology Control Regime (MTCR), supplemented by the International Code of Conduct Against Ballistic Missile Proliferation (known as the Hague Code of Conduct), are voluntary agreements among nations that wish to manage the growing proliferation threat. The MTCR, established in 1987, provides a list of items to be controlled through its “MTCR Equipment, Software, and Technology Annex”. The goal of the MTCR is to make foreign acquisition, or development, of delivery systems more difficult and costly, especially if major producers restrict exports. The MTCR targets the proliferation of ballistic and cruise missiles, rockets, and unmanned aerial vehicles (UAV) capable of delivering weapons of mass destruction.⁵³ Specifically, the MTCR places restrictions on the export of ballistic missiles and related technologies that can achieve a range of 300 kilometres or more and a weight of 500 kilogrammes in payload or more which are considered to be nuclear capable.⁵⁴

⁴⁷ Borawski, John. “Accord at Stockholm.” *Bulletin of Atomic Scientists*, Dec. 1986: 35.

⁴⁸ The Istanbul Commitments are a series of unilateral and bilateral statements which formed a “package deal” among the 30 CFE States Parties resulting in the signature of the 1999 CFE Final Act and agreement on the Adaptation of the CFE Treaty. The provisions are focused on levels of holdings of Treaty-Limited Equipment, deployments and forces stationed on the territory of another state. They are contained in 14 Annexes to the CFE Final Act and in paragraph 19 of the OSCE’s 1999 Istanbul Summit Declaration. (Questions and answers on CFE. North Atlantic Treaty Organization. 20 July 2010. <http://www.nato.int/issues/arms_control/cfe_qa_factsheet.pdf>.)

⁴⁹ This excluded the disputed Gudata military base in the breakaway region of Abkhazia.

⁵⁰ The Preamble called on the state parties, among other things, to refrain from ‘the threat or use of force against the territorial integrity or political independence of any state’.

⁵¹ Lachowski, Zdzislaw. “The CFE Treaty One Year After its Suspension: A Forlorn Treaty?” *SIPRI Policy Brief*, Jan. 2009.

⁵² “Forum for Security Co-operation – CSBMs.” The Organization for Security and Co-operation in Europe. 20 July 2010. <<http://www.osce.org/fsc/22154.html>>.

⁵³ “The Missile Technology Control Regime” 05 Jul. 2010. <<http://mtcr.info/english/index.html>>.

⁵⁴ Crail, Peter. “Iran Makes First Successful Space Launch.” *Arms Control Today* 39.2 (2009): 42.

1999 Vienna Document	
Transparency Measures	<ul style="list-style-type: none"> Recognising the benefits of implementation of confidence- and security-building measures by the participating States Regional Measures: encouragement of separate bilateral, multilateral or regional measures
Informational Measures	<ul style="list-style-type: none"> Annual Exchange of Military Information (Information on military forces, Data relating to major weapon and equipment systems; Information on plans for the deployment of major weapon and equipment systems) Defence Planning (Exchange of information; Clarification, review and dialogue, Possible additional information [e.g. military documents and/or white papers])
Consultative Measures	<ul style="list-style-type: none"> Risk Reduction (Mechanism for consultation and cooperation concerning unusual military activities; Cooperation on hazardous incidents of a military nature; Voluntary hosting of visits reducing concerns about military activities) Annual Implementation Assessment Meetings
Notification Measures	<ul style="list-style-type: none"> Prior notification of certain military activities Exchange of an annual calendar of military activities prior to notification within the zone of application of CSBMs as well as forecasts for the subsequent calendar year
Constraint Measures	<ul style="list-style-type: none"> Constraining Provisions (with regard to military activities) Compliance and Verification
Access Measures	<ul style="list-style-type: none"> Visit to air bases Programme of military contacts and cooperation <ul style="list-style-type: none"> *Military contacts *Military cooperation (visits to military facilities, forces in the field and observation visits of certain military activities; provision of experts to be consulted on matters of defence and security; seminars on cooperation in the military field; informational exchanges on agreements concerning military contacts and cooperation) Demonstrations of new types of major weapon and equipment systems Provision of information on contacts Observation of certain military activities Inspections

Table 2: Confidence- and Security-Building Measures in the Vienna Document

Over the past two decades, the MTCR has gradually shifted its attention from controlling only member-state exports to non-member missile threats. The MTCR Guidelines and Annex serve as a standard for responsible non-proliferation behaviour.⁵⁵ With regard to space, although the MTCR recognises that “the technology used in a space launch vehicle is virtually identical to that used in a ballistic missile” it does not offer guidance concerning how to differentiate one from the other.⁵⁶ It wisely defines a space launcher as a missile for all practical purposes and bans the sale of its key technologies. The ban

excludes “responsible” governments which commit to strict procedures of end-use.⁵⁷ In Northeast Asia, China and North Korea are the only countries not participating in this regime.

The International Code of Conduct Against Ballistic Missile Proliferation (the Hague Code of Conduct)

The Hague Code of Conduct is a set of norms seeking to address missile proliferation. Given the similarities between the technologies used in ballistic missiles and civilian rockets, the Hague Code also introduces transparency measures such as annual declarations and pre-launch notifications regarding ballistic missile and space launch programmes. It attempts to build a formal or-

⁵⁵ McNerney, Patricia. “Principal Deputy Assistant Secretary McNerney Addresses Conference on Global Perspective of Proliferation Landscape.” (Remarks at the Naval Postgraduate School). Monterey: US FedNews: 10 June 2008.

⁵⁶ “MTCR Guidelines and the Equipment, Software and Technology Annex.” The Missile Technology Control Regime. 22 Apr. 2010. <<http://www.mtcr.info/english/guidelines.html>>.

⁵⁷ Rubin, Uzi. “America’s New Space Rivals: Iran, North Korea Swoop To Conquer.” The Washington Times, 20 Mar. 2009. A15.



organisation that would oversee the status of its CBMs and control mechanisms.⁵⁸ Austria serves as the Immediate Central Contact (Executive Secretariat) and coordinates information exchange within the framework of the Hague Code of Conduct.⁵⁹

Neither MTCR nor the Hague Code of Conduct, however, are legally binding. Accordingly, the effectiveness of the Hague Code has been uneven. This Code is another example of the fact that international agreements discouraging missile deployment and proliferation do not presently provide an adequate solution. The Hague Code of Conduct will be also examined in connection with the draft EU Code of Conduct.

The Wassenaar Arrangement (WA)

The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies replaced in 1996 the Coordinating Committee for Multilateral Export Controls (known as CoCom). The CoCom was the Cold War organisation controlling the export of militarily-sensitive technologies to communist states. As of December 2009, 40 members are participating in the arrangement designed, among other objectives, to promote transparency and greater responsibility in the transfer of conventional arms and dual-use equipment and technologies on the part of suppliers. The effectiveness is diminished by the consensus nature of decision-making, the complicated list of controlled goods, and somewhat lax control regime where each national government regulates its own exports. The main confidence-building measure is the sharing of information on potential threats to stability and dangerous acquisition trends.⁶⁰

Ottawa Convention

The goal of the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, in force since 1999, is to terminate the use of anti-personnel landmines (APL) globally.⁶¹ This initiative was the result of an effort by a group of non-governmental or-

ganisations (NGOs) and a number of smaller countries. In 2009, the Ottawa Convention on the prohibition of anti-personnel landmines celebrated the tenth anniversary of its entry into force. During those ten years, more than 41 million stockpiled antipersonnel mines were destroyed. As of June 2008, 156 countries have ratified or acceded to the Treaty, but key countries like the U.S., China, India, Pakistan and Russia have, thus far, refused to sign. Most state-parties come from Europe, Africa, Latin America and the Caribbean. Only about half of the countries in the Asia-Pacific region have signed the Treaty and almost no countries in the Near East.⁶²

2.2 Current Status of Terrestrial TCBMs

With regard to the nuclear weapons management during the Cold War, the transparency measures practiced by the NWS were limited to U.S.-Soviet bilateral exchanges on nuclear delivery vehicles and information provided by national technical means, mainly space-based intelligence. Disclosure of other information, including nuclear incidents, production of weapon-grade fissile materials (with the exception of the UK and the U.S. which have released details about past production of plutonium)⁶³, and production of nuclear weapons, has been uneven.

The environment of nuclear arms control witnessed rapid transformation when other countries began testing their nuclear weapons. Mounting concerns over nuclear fallout led to the 1963 Partial Test Ban Treaty limiting signatories to underground testing only. The Non-Proliferation Treaty (NPT) introduced the principle of transparency into the policies of the five legally recognised nuclear weapon states (NWS). Nuclear transparency was again stressed at the 2000 Review Conference of the NPT. It proposed, among other items, "increased transparency as a voluntary Confidence-Building Measure to support further progress in disarmament". It was the first major commitment to nuclear transparency accepted by all five NWS in an international framework.⁶⁴ The 2000 NPT Review Conference established transparency as a

⁵⁸ Feickert, Andrew. "Missile Survey: Ballistic and Cruise Missiles of Selected Foreign Countries." Washington DC: Congressional Research Service of the U.S. Library of Congress. 05 July 2010.

<<http://www.fas.org/sgp/crs/weapons/RL30427.pdf>>: 6.

⁵⁹ "Hague Code of Conduct against Ballistic Missile Proliferation (HCOC)." The Austrian Foreign Ministry. 27 July 2010. <<http://www.bmeia.gv.at/index.php?id=64664&L=1>>.

⁶⁰ Gärtner, Heinz. "The Wassenaar Arrangement (WA): How it is Broken and Needs to be Fixed", Defense and Security Analysis 24.1 (2008): 53–60.

⁶¹ The test of the Convention can be accessed at:

<http://www.un.org/Depts/mine/UNDocs/ban_trty.htm>.

⁶² "The Ottawa Convention: Signatories and State-Parties." June 2008. Arms Control Association. 20 July 2010.

<<http://www.armscontrol.org/factsheets/ottawasigs>>.

⁶³ The U.S. figures, released in 1996, were part of the Openness Initiative.

⁶⁴ Grand, Camille. "Nuclear weapon states and the transparency dilemma." Transparency in Nuclear Warheads and Materials: The Political and Technical Dimensions. Ed. Nicholas Zarimpas. Oxford University Press, 2003.

permanent element of nuclear diplomacy of the NWS.

As described in the previous section, management of nuclear-related activities to date have included unilateral declarations and actions; bilateral treaties/agreements and nuclear cooperative efforts (largely limited to the U.S. and Russia); multilateral agreements involving only the NWS and other multilateral arrangements. From these, the following TCBMs can be identified:

- Sharing information about efforts in the field of nuclear disarmament⁶⁵
- Sharing information about nuclear weapons holdings⁶⁶
- Engaging in national and international events, including major nuclear policy speeches⁶⁷
- Publication of nuclear doctrines or statements on doctrines⁶⁸
- Exchanging nuclear policies between the NWS
- Communicating information to the international community (and potential adversaries) about NWS's efforts, including reassurance policies and verification mechanisms
- Concluding bilateral agreements providing for disclosure of the number of dismantled nuclear weapons and demonstrating the effective destruction of weapon systems
- Signing and adhering to bilateral and multilateral agreements, including the 1963 Partial Test Ban Treaty (PTBT), 1987 Treaty on the Elimination of Intermediate-Range and Shorter Range Missiles (INF Treaty), and the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms (START I Treaty) and by doing so accepting the principle of on-site inspections as a means of verifying the test ban
- Inspection visits to sensitive nuclear sites, including warhead storage, under the Cooperative Threat Reduction pro-

gram and material protection, control and accounting (MPC&A) agreements⁶⁹

Naturally, progress in negotiating and implementing TCBMs related to arms control and nonproliferation initiatives has always been influenced by broader geopolitical developments, as well as technological modernisation. For example, U.S. President Richard Nixon focused on stability and chose a cooperative approach to space and arms control.⁷⁰ In 1972, this contributed, together with the Cold War environment, to the signing of the Anti-Ballistic Missile (ABM) treaty, one of the first major security agreements involving space. In 1987, the Intermediate-Range Nuclear Forces (INF) Treaty, became the first nuclear arms control agreement to actually reduce nuclear arms, introduce unprecedented on-site inspections and the most comprehensive verification regime of the period. On the technology front, intercontinental ballistic missiles (ICBM) gradually replaced bombers as the principal delivery vehicle for nuclear weapons. This transition led to a "massive retaliation" doctrine based on "parity" of strategic nuclear weapons.

A present question is to what extent are the NWS, including the non-NPT states (i.e. India, Pakistan, and North Korea) and Israel (undeclared nuclear state), willing to give up secrecy for transparency. Arguably, secrecy is more important for smaller countries, as it can hide technological backwardness and other weaknesses. Moreover, countries with strong centralised governments, like the former Soviet Union or today's China, generally resist transparency.⁷¹ Among its perceived attributes, secrecy is considered a component of deterrence as certain transparency measures could be exploited by potential adversaries. For this reason, it has often been weaker states that push for transparency measures by larger powers to help protect themselves. Accordingly, transparency measures need to demonstrate that they do not inadvertently compel the disclosure of militarily-useful information in the hands of would-be proliferators.

Nuclear transparency has been, with the notable exception of China, partially successful with respect to weapon holdings and capabilities. At the same time, there is no common approach to nuclear weapon holdings which complicates comparative assessments. A

⁶⁵ For example, through public documents (e.g. brochures for international events), etc.

⁶⁶ The data on the number of treaty-accountable delivery vehicles held in each of the parties' inventories are exchanged every six months under the terms of START I

⁶⁷ For example, U.S. President Obama's "nuclear weapons reduction" speech in Prague in April 2009.

⁶⁸ These are useful even when they are subject to change and may be part of a deception strategy, as they enhance stability and arguably reduce the danger of the unintended use of nuclear weapons.

⁶⁹ The warhead facilities are off-limits to inspectors.

⁷⁰ Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 159.

⁷¹ Grand, Camille. "Nuclear weapon states and the transparency dilemma." *Transparency in Nuclear Warheads and Materials: The Political and Technical Dimensions*. Ed. Nicholas Zarimpas. Oxford University Press, 2003.



comprehensive, detailed description of nuclear arsenals has not, as yet, been provided by any NWS and the key technical aspects such as the yield, range and operational status of existing weapon systems are highly classified. Also, not all NWS have exchanged data or accepted inspections. Concerning fissile material holdings, the UK and the U.S. have released information about their fissile material stockpiles. France, China and Russia, have been reluctant to follow this lead. The transparency measures practiced by the U.S. and Russia are most often linked to formal agreements (e.g. START I) and reveal only the number of treaty-accountable weapons. Accordingly, the information involves primarily delivery vehicles and only limited information on the number of warheads. Tactical nuclear weapons are almost always excluded from official accounts.⁷²

As evidenced above, the most common form of transparency has consisted of unilateral declarations and actions based on a national political choice, with the occasional involvement of external actors (e.g. IAEA monitoring teams and visits by foreign inspectors). Existing bilateral treaties and agreements have been, for the most part, limited to the U.S. and Russia. NWS have not entered into a multilateral agreement and the three smaller NWS are not inclined to commit to a binding arms reduction process. Multilateral agreements involve, for example, IAEA safeguards, the Comprehensive Nuclear Test-Ban Treaty Organization, or FMCT, the latter two of which remain under development.

Proponents of collective security maintain that transparency measures, including military-to-military exchanges, and arms control should be viewed as preliminary steps to future formal security structures.⁷³ At the same time, there is little evidence that the Cold War arms control TCBMs, although helpful, imposed serious obligations or burdens on the U.S. and the Soviet Union. For example, the ABM Treaty was signed at the time when neither party had the technology to deploy effective missile defences and therefore did not especially constrain them. Provisions of the treaty were likewise often violated.⁷⁴

⁷² Grand, Camille. "Nuclear weapon states and the transparency dilemma." *Transparency in Nuclear Warheads and Materials: The Political and Technical Dimensions*. Ed. Nicholas Zarimpas. Oxford University Press, 2003. 32-49.

⁷³ Russell, Richard L. "The Persian Gulf's Collective-Security Mirage." *Middle East Policy* XII.4 (2005): 78.

⁷⁴ Gundlupet, Vaidya. "Façade of Mutual Abstinence: Security Institutions Between Equal Powers." Abstract from a conference papers: International Studies Association, 2007 Annual Meeting.

In Europe, the CFE Treaty continues to struggle with ratification of the Adaptation Agreement by majority of its signatories, as well as with Treaty compliance, particularly with respect to the Treaty's "flank" limits on ground forces in North Caucasus military districts. Some believe that the OSCE played an influential role in the peaceful transition from the Cold War to the current situation in Europe. It is important to note here, however, that it was not arms control agreements and transparency measures that hastened the demise of the Soviet Union. In short, there is little evidence that collective-security organisations offer a superior deterrent than the balance of power. Most experts agree that political tools, including confidence-building measures, are useful in promoting stability under certain conditions, but they do not alter the fundamental geopolitical landscape determined by different national interests and individual state agendas.⁷⁵

Other post-Cold War treaties of the 1990's, including the Strategic Arms Reductions Treaties (START I, START II and New START), the Comprehensive Nuclear Test Ban Treaty (CTBT), and the Chemical Weapons Convention, seemed to have set the course for a new era of restraint on weapons deployment and transfers, as well as military operations. Protracted ratification and implementation procedures associated with these treaties, however, have dampened the enthusiasm of policy-makers. Although some progress occurred, for example, in 1997 with the ratification of the Chemical Weapons Convention by the U.S. and Russia and a broadly accepted agreement banning the use of anti-personnel land mines (although a number of major nations, including the U.S., are not signatories).

There have also been notable set-backs. For example, the number of nuclear weapons had risen from three to 80,000 explosive devices during the Cold War, and the effectiveness of the NPT was questioned due nuclear developments in India, Pakistan, Iran and North Korea. At the same time, the costs of consensus with regard to, for example, the NPT, are high. The 1993 START II Treaty never entered into force and was replaced by the more general Strategic Offensive Reductions Treaty (the Moscow Treaty) in 2002. In 1999, the U.S. Senate did not approve the CTBT, and in 2002 the U.S. withdrew from the ABM Treaty and rejected the verification protocol of the Biological Weapons Convention. These were vivid demonstrations of the scepticism

⁷⁵ Russell, Richard L. "The Persian Gulf's Collective-Security Mirage." *Middle East Policy* XII.4 (2005): 81.

concerning the benefits of binding arms control agreements.⁷⁶

President Obama entered office with the promise of greater multilateral cooperation. He resumed bilateral negotiations with Russia, and announced support for a number of multilateral arms control and nonproliferation efforts. Among these were a new strategic arms control treaty with Russia (New START), a strengthened Nuclear Nonproliferation Treaty, an effort to secure the ratification of the Comprehensive Test Ban Treaty, and even a Fissile Material Control Treaty. Credible and substantive TCBMs that employ each nation's military, diplomatic, and economic tools to advance their security interests will be needed to realise these ambitious goals.

In May 2010, the NPT review was concluded with broad agreement but few steps forward. Although Iran endorsed the declarations about strengthening nuclear safeguards, it continues to be a serial violator of the treaty's anti-nuclear rules. North Korea is another point in case. Since it stepped out of the Treaty in 2003, it has tested two bombs without any harsh repercussions. Besides North Korea, other relevant countries (i.e. Israel, Pakistan and India) remain outside the NPT as they expand their arsenals. IAEA inspectors are often helpless when trying to accomplish their mission of inspecting Iran's and Syria's nuclear facilities. Accordingly, NPT members have a difficult time persuading the world of the value of the treaty.⁷⁷ Under the current framework, there is an insufficient obligation for states to monitor ominous developments in the nuclear field. Moreover, the formerly sharp division between states and non-states has been made more permeable.

Multilateral fora, such as the MTCR regime and the Hague Code of Conduct, are indispensable in curtailing proliferation activities, but need to be further augmented. Denial of technologies and components alone will not accomplish the objectives of counterproliferation efforts, but can contribute to disrupting illegal networks and increasing transaction costs. Given the globalised nature of proliferation, multilateral coordination and enforcement measures also need to be strengthened further. This includes the occasional use of unilateral measures like financial sanctions. When considering non-binding restrictions, it should be kept in mind that interstate relations rest in a significant way

on each knowing the other's economic strength and military capabilities.

The U.S. has now endorsed the benefits of unilateral measures in the form of targeted sanctions, for example, when it agreed on 24 April 2009, to impose financial sanctions on three North Korean firms linked to Pyongyang's nuclear and missile-related trade, an unprecedented step by the UN.⁷⁸ Although North Korea acted defiantly by restarting its Yongbyon nuclear facility, expelling IAEA inspectors, and excluding any possibility of returning to the Six-Party Talks, should such targeted measures be applied, results will show over time.⁷⁹ In short, there are few, if any, good policy options left as the international community has largely exhausted its capacity to stop, much less reverse, ballistic missile development, deployment, and lucrative proliferation activities.

To conclude this section, several observations can be made. As showcased by the Cold War period, bilateral agreements tend to be easier to achieve. Multilateral agreements have the benefit of binding states to greater responsibility, disciplined by peer pressure. It is also evident that binding instruments are more effective than soft law which carries less accountability for the signatories. At the same time, treaties that do not include verification mechanisms invite violations and need to be updated on the basis of geopolitical and technological realities.⁸⁰ When looking at the NPT, a comprehensive treaty, it was signed not only due to security imperatives internationally, but also because of the willingness of the two largest powers to comply.

During all of these negotiations, the level of transparency, or openness, was contingent on individual nation's preservation of security. Accordingly, when proposing a transparency measure, it should be accompanied by a solid argument concerning the overriding security benefits. It is likewise clear that transparency measures need to be promulgated during the times of relative peace. Governments seek the proper balance between transparency in military doctrines and postures and national security concerns so that greater transparency does not undermine military effectiveness and bedrock secu-

⁷⁶ Woolf, Amy F., Mary Beth Nikitin, and Paul K. Kerr: "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements". Congressional Research Service 2 Feb. 2010.

⁷⁷ "Consensus Costs." *Economist* 395.8685 (2010): 68.

⁷⁸ Lauria, Loe. "UN Panel Sets Sanctions on 3 North Korean Firms Over Rocket Launch." *The Wall Street Journal*, 24 Apr. 2009.

⁷⁹ Unilateral U.S. financial sanctions have, thus far, been imposed on two terrorist-sponsoring states, North Korea and Iran.

⁸⁰ Williamson, Richard. "Space Security Lessons from 'Terrestrial' Arms Control." Eds. Jana Robinson et al. *Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security*. ESPI Report 27. Vienna: European Space Policy Institute (2010).



city interests. Accordingly, it is important to focus on the process and modalities of implementing TCBMs, to better understand the

risks and benefits associated with these measures.

3. Space-Related TCBMs

The U.S.-Soviet competition shaped, and was shaped by, space behaviour during the Cold War. A substantial part of this relationship involved a reasonably good understanding by each side of the intentions and policies of the other which helped prevent conflict. Since the 1960s, “negotiated approaches” have dominated the policy landscape and yielded key Space Treaties.⁸¹ Specifically, the Limited Test Ban Treaty (LTBT) of 1963 prohibited nuclear testing, or any other nuclear explosions, in space, constituting a major step toward reducing harmful behaviour in space. According to some experts, this development was less attributable to successful arms control than it was recognition on the part of these two space powers of the inherent incompatibility of nuclear testing with other uses of space (e.g. manned spaceflight, reconnaissance etc.). Similarly, one of the reasons behind the Outer Space Treaty (OST) was the need to protect secret Cold War military reconnaissance missions. It can, therefore, be argued that the desire to prevent damage to passive military systems was stronger than the military objective of securing the future use of weapons in space.⁸² Accordingly, the nature of the space environment itself influenced decision-making concerning behaviour in space.⁸³

As referenced above, some of the terrestrial Cold War arms control agreements included space-related provisions. Space also facilitated nuclear arms control with the help of spy satellites as national technical means (NTM). The NTM was the key enabler for the LTBT and SALT. The 1987 Intermediate-Range Nuclear Forces (INF) Treaty introduced on-site inspections in addition to the NTM. Accordingly, as Clay Moltz points out, it is questionable to what extent formal top-down arms control advanced military restraint in space, hence his preference for a bottom-up approach.⁸⁴ An interesting analogy can be drawn from international maritime law, which has evolved from a set of rules designed to avoid naval warfare toward a new global framework designed to facilitate maritime

security cooperation. As James Kraska describes, the nature of sea power has been configured by forging agreements which unite efforts to enhance global shipping and combat maritime piracy, terrorism, proliferation of WMDs, and narcotics trafficking. Indeed, international law now serves as an effective tool to promote maritime security on a global basis by broadening maritime partnerships and developing norms.⁸⁵

3.1 Current Proposals for Organising, Managing, and Regulating Space Activities

Today, there exist proponents of both top-down and bottom-up approaches to preserving the space environment for safe and secure operations. Although no uniform definition of these approaches has been adopted, it can be argued that both involve governments at a certain stage. In the initiation, negotiation, adoption, and implementation of new policies, the top-down approach involves the government from the outset. The bottom-up concept generally begins with non-governmental entities (e.g. academia, think tanks, scientific communities, etc.) in the initial stage. Bottom-up policy development helps create frameworks for specific, narrow purposes until the sum of these “stove-piped” policies achieves, or at least nears, the overarching goal of more comprehensive rules for space conduct. Ultimately, the negotiation and adoption process of both approaches is carried out by governments. Implementation can involve both governments and non-governmental entities.

Currently the scale is tilted somewhat more on the side of bottom-up approaches as there is a more urgent need to achieve “critical mass” consensus on how to manage key space activities internationally. The argument is based on the premise that building, at least initially, a series of multilateral agreements on different subjects can positively influence, over time, the overall space security matrix.

⁸¹ Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 12.

⁸² *Ibid.*: 306.

⁸³ *Ibid.*: 46.

⁸⁴ *Ibid.*: 45.

⁸⁵ Kraska, James. “Grasping ‘The Influence of law on Sea Power.’” *Naval War College Review* 62.3 (2009): 113–115.



TCBMs play a supportive role in a number of bottom-up proposals that are presently being considered. They include the Debris Mitigation Guidelines; Codes of Conduct/Rules of the Road; Advancement of safety measures for space operations; Best Practices Guidelines; the Space Traffic Management (STM) concept and commercial operator initiatives (e.g. Space Data Association).

Below is a brief overview of a number of proposed top-down and bottom-up approaches that seek to enhance space security either via treaty-based arms control or weapons bans, or through non-binding behaviour modification.

3.1.1 Top-Down Proposals

These proposals have included the Draft Treaty on the "Prevention of Placement of Weapons in Outer Space (known as PPWT), The UN General Assembly Transparency and Confidence-Building Measures Resolutions, a working paper on the "Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security" introduced by Canada, efforts to expand Space Situational Awareness internationally, and the EU Draft Code of Conduct for Outer Space Activities.

Draft Treaty on the "Prevention of Placement of Weapons in Outer Space" (PPWT)

Formal space arms control treaty proposals continue to be put forth, the most prominent of them being China's and Russia's PPWT proposal. Since the 1980s, China and Russia exerted effort to develop an international treaty banning the development of space weapons. The "prevention of an arms race in outer space" (PAROS) has been mainly discussed at the Conference on Disarmament (CD). In 1981, UNGA Res. 36/97C on PAROS states that the CD, as the single multilateral disarmament negotiation forum, has the primary role in the negotiation of multilateral agreement(s) on the PAROS.⁸⁶ Between 1985 and 1994, a CD-based ad hoc committee existed to work on the topic. In 1995, the ad hoc Committee on PAROS was not re-established and the discussions later continued on a more informal basis. Progress has been minimal, however, as China on one side has insisted that PAROS be part of other discussions at the CD, including negotiation on a Fissile Material Cut-Off Treaty (FMCT), and the U.S. on the other expressing the view that there was no arms race and thus a ne-

⁸⁶ UNGA Res. 36/97C. <http://www.oosa.unvienna.org/pdf/gares/ARES_36_97E.pdf>.

gotiating mandate on PAROS was unnecessary. In June 2002, China and Russia, together with other countries (e.g. Vietnam, Indonesia, Belarus, Zimbabwe and Syria), introduced a Joint Working Paper on "Possible Elements for a Future International Legal Agreement on the Prevention of the Deployment of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects."⁸⁷ Other "non-papers" on the issue followed and in 2008 Russia and China proposed a PAROS legal instrument, a draft "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat of Use of Force against Outer Objects" (PPWT).⁸⁸

In May 2009, the CD broke the deadlock by agreeing to a formal programme of work, including an agreement to establish a working group on the "Prevention of an arms race in outer space (PAROS)", as well as launching negotiations on a treaty limiting the production of fissile material for nuclear weapons/explosive devices.⁸⁹ As of July 2010, the CD was unable to implement a work programme due to objections on the part of a number of countries, including Pakistan.⁹⁰ Progress on the issue may continue to be modest to poor as it has already been partially discredited by the first purposeful destructive act in orbit by China in 2007. Accordingly, some countries, including the U.S., still look with scepticism on these efforts, particularly given intelligence assessments concerning, for example, China's development of offensive counterspace capabilities. Criticisms of the proposed treaty included its "non-comprehensiveness" or narrow approach focused on ill-defined capabilities without adequately considering the fact that many technologies can perform both beneficial and hostile missions.

Besides the PPWT, there is also the Henry L. Stimson Center's proposed "Treaty Banning the Testing and Use of Destructive Methods Against Space Objects" focusing on space debris mitigation. A key barrier to concluding

⁸⁷ „Press Release by the Delegation of China to the Conference on Disarmament". <<http://www.nti.org/db/china/engdocs/spacpres.htm>>.

⁸⁸ Hitchens, Theresa. "Saving Space: Threat Proliferation and Mitigation." International Commission on Nuclear Non-proliferation and Disarmament. 26 July 2010. <http://www.icnnd.org/research/Hitchens_Saving_Space.pdf>.

⁸⁹ Conference on Disarmament. "Draft Decision for the establishment of a Programme of Work for the 2009 session." Doc. CD/1863 of 19 May 2009. 26 July 2010. <<http://www.reachingcriticalwill.org/political/cd/papers09/2session/CD1863.pdf>>.

⁹⁰ For CD/1889, see: <<http://www.reachingcriticalwill.org/political/cd/2010/reports.html>>.

a space weapons ban has been the difficulty in defining space weapons. Focusing on technologies rather than on behaviour also compounds the verification dilemma.

Working Paper on "Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security"

Another initiative at the CD involves Canada and its informal working group seeking to address TCBMs. This initiative follows Russia's introduction of the resolutions on TCBMs for space in the UN General Assembly in years 2005, 2006, 2007, and 2008. Interestingly, the 2008 resolution explicitly refers to the draft PPWT.⁹¹ In June 2009, Canada formally introduced at the CD a working paper on "The Merits of Certain Draft Transparency and Confidence Building Measures and Treaty Proposals for Space Security."⁹² The proposal leans toward a treaty arrangement that would include a ban on placing weapons in outer space, a prohibition on testing or use of weapons against any satellites, and a prohibition on testing or using satellites as weapons.⁹³ It seeks to blend all existing space security proposals into a compromise that would work for all major space-faring nations.

Debates on how to achieve such formal arrangements often draw on "terrestrial" precedents. For example, the Antarctica Treaty is often cited as a good model for efforts that seek to achieve a governance structure for space activities. Antarctica was originally used for whale and seal hunting, and, later, for scientific research. A number of countries made formal claims on Antarctica territory at the beginning of 20th century. Regional claims by states led to tussles that instigated the danger of militarisation of Antarctica. As a result, twelve countries which had research stations there in 1959 established the Antarctic Treaty. States agreed to suspend territorial claims, ban all military activities, denuclearise, and conduct science in an organised fashion. Verification means were likewise established through the right of free inspection of local bases.

Accordingly, a strong cooperative agreement replaced former rivalry. In the late 1980's, select nations wanted to explore for Antarctic oil, minerals and seafood, and commercialisation of Antarctica seemed inevitable. However, after a broad campaign against this trend, Treaty members unanimously agreed on a prohibition of mining in Antarctica for fifty years. Although space relevance is tempting, differences do exist. Unlike in the Antarctic case, space has already experienced military testing, commercial use, and large-scale spending for space operations. Accordingly, space has greater potential for political, economic and military conflict.⁹⁴

Improved Space Situational Awareness (SSA)

No standardised regime, or organisation, systematically analyses and communicates threats to the satellites orbiting the Earth. To move a spacecraft in order to avoid potential collision, the operator needs to obtain key information. It includes the awareness of the situation, accurate spacecraft/debris positions and their future trajectories, and an assessment of the collision probability to include an error margin around each object.⁹⁵ Today only the U.S. has a comprehensive system now in place worldwide. Russia has only a limited SSA capability and China seeks to develop such a capability.

The American SSA programmes monitor potential threats from man-made objects, including satellites and other spacecraft, space debris and ASAT weapons.⁹⁶ The Space Surveillance Network (SSN), a network of ground-based telescopes and radars, is operated by the U.S. Air Force Space Command (AFSPC). A series of space-based sensors are planned to be deployed, the first of which, the Space Based Space Surveillance (SBSS) Pathfinder satellite, as soon as this year. The U.S. shares space situational awareness data with organisations outside the U.S. government, originally through a pilot program by Air Force Space Command, the Commercial and Foreign Entities (CFE) program, now a permanent SSA Data Sharing Program run by the U.S. Strategic Command (USSTRATCOM). As of April 2010, USSTRATCOM had 16

⁹¹ Hitchens, Theresa. "Saving Space: Threat Proliferation and Mitigation." International Commission on Nuclear Non-proliferation and Disarmament. 26 July 2010. <http://www.icnnd.org/research/Hitchens_Saving_Space.pdf>.

⁹² "Working Paper on the 'Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security'." 21 Jul. 2010. <<http://www.reachingcriticalwill.org/political/cd/papers09/1session/Canada-PAROS.pdf>>

⁹³ "Assessing the Current Dynamics of Space Security." A SWF-Ifri Conference Report. 18–19 June 2009, Paris. 10.

⁹⁴ Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, CA: Stanford University Press, 2008. 20–23.

⁹⁵ Cox, Lee-Volker. "Avoiding Collisions in Space: Is it Time for an International Space Integration Center?" Carlisle Barracks: U.S. Army War College (2007). 3.

⁹⁶ Nardon, Laurence. "Space Situational Awareness and International Policy." *Institute Francais des Relations Internationales* 14 (2007). 2.



agreements with commercial entities to share SSA data.⁹⁷

With regard to Europe, in late 2008, the European Space Agency (ESA) approved €50 million to formulate a SSA capability.⁹⁸ ESA defines SSA as the “understanding and maintained awareness of the Earth orbital population, the space environment and possible threats to space assets”.⁹⁹ Since the system should be able to operate with the U.S. Air Force’s Space Surveillance Network (SSN), a heated debate is underway concerning the interoperability of the future European system and rules governing access to the data. It is spear-headed by France and Germany, countries that will provide the initial infrastructure for the project (via combining the French Graves and German Tira ground radar facilities), as well as seek to define the associated requirements.

The goal is to have a system capable of identifying relevant threats to military assets, preventing collisions and reducing LEO risk by 90%; establishing a recognised space picture suitable for understanding the space environment; and proper management of the dissemination of system data.¹⁰⁰ As stated by ESA, current military needs, including upgraded and expanded ground infrastructure and possible space components, may increase the development time and costs for the full system to 6–7 years and € 1–1.3 billion, respectively. As of July 2010, thirteen ESA Member States are participating in the SSA programme.¹⁰¹ The approval for development is expected at the next ESA Ministerial summit in late 2011–12.¹⁰² The challenge for future European-American cooperation will be, in part, how best to coordinate data sharing policy.¹⁰³

The importance of SSA is growing due primarily to the urgent need to identify means to safeguard space assets from collisions and external interference. The SSA portfolio has the potential to become one of few security

space arenas where governments could create genuinely cooperative ties. The U.S. currently views cooperation on SSA as a building-block enterprise. The Lisbon Treaty now enables new opportunities for Europe to act as a catalyst and mediator in attaining international cooperation in the broader space field, and especially space security. One of these efforts, relevant to SSA, is the EU Draft Code of Conduct for Outer Space Activities (the EU Code of Conduct) which will be discussed in greater detail in Chapter 4.

3.1.2 Bottom-Up Proposals

Code of Conduct/Rules of the Road

Beyond the EU Code of Conduct for Outer Space Activities, a “Model Code of Conduct for Responsible Space-Faring Nations” has been put forth by the U.S.-based Stimson Center. The Stimson Center has been one of the leaders in emphasising the development of an international, non-binding code of conduct for responsible space-faring nations that sets out so-called “rules-of-the-road” for operations in outer space to be agreed upon internationally.¹⁰⁴ The key elements of the code include: “non-interference with satellites; the prevention of activities resulting in persistent orbital debris; information exchanges and consultations concerning space activities in general; information exchanges and consultations regarding activities that might be construed as either interfering or debris-creating; the coordination of spectrum use (e.g. RF) and orbital slot allocation; and space traffic management”.¹⁰⁵

Space Debris Mitigation Guidelines

International guidelines for the mitigation of space debris have been primarily a result of the work of the Interagency Space Debris Coordinating Committee (IADC) that commenced in the early 1990’s. The IADC is an association of ten countries (i.e. China, France, Germany, India, Italy, Japan, Russia, Ukraine, the UK, and the U.S.) and the European Space Agency (ESA). The IADC Space Debris Mitigation Guidelines, formally adopted in 2002, is a technical document that seeks to curtail the accumulation of debris in LEO and GEO orbits. Missions to geosynchronous orbits, for example, accounted for 40% of all missions to Earth orbit and beyond between 2000 and 2003. Most of these missions

⁹⁷ Foust, Jeff. “A New Eye in the Sky to Keep an Eye on the Sky.” *The Space Review*. 10 May 2010. <http://www.thespacereview.com/article/1622/1>.

⁹⁸ Taverna, Michael. “European: SSA No Challenge to U.S.” *Aviation Week & Space Technology* 172.16. 34.

⁹⁹ Del Monte, Luca, Vincent Martinot, Thomas Schildknecht, and Therese Donath. “Possible European systems for space situational awareness.” *Acta Astronautica* 66.9/10 (2010). 1378–1387.

¹⁰⁰ Taverna, Michael. “European: SSA No Challenge to U.S.” *Aviation Week & Space Technology* 172.16. 34.

¹⁰¹ “Two member states join SSA programme.” 6 July 2010. ESA. 21 July 2010.

¹⁰² http://www.esa.int/esaMI/SSA/SEM_XJ2MZLAG_0.html.

¹⁰³ Taverna, Michael. “European: SSA No Challenge to U.S.” *Aviation Week & Space Technology* 172.16. 34.

¹⁰⁴ The content of the new NATO’s Strategic Concept document due in the fall 2010 with regard to protection of military space assets will likewise play a role.

¹⁰⁴ The Stimson Center Code of Conduct can be accessed at:

<http://www.stimson.org/space/?SN=WS200702131213>.

¹⁰⁵ Black, Samuel. “No Harmful Interference with Space Objects: The Key to Confidence-Building.” *Stimson Center Report* 69 (2008): 10.

leave object(s) in geosynchronous transfer orbits (GTOs) and increase the space debris population.¹⁰⁶ Four areas of concern were identified:

- Limitation of debris release during normal operations
- Reduction of the potential for break-ups on-orbit, as well as during and after space operations
- Post-mission disposal recommendations for vehicles in LEO (below 2,000 km altitude), GEO and other orbital regimes
- Prevention of on-orbit collisions¹⁰⁷

The IADC guidelines formed a foundation for discussions within the UN Committee on the Peaceful Uses of Outer Space's (COPUOS) Scientific & Technical Subcommittee (STSC) on internationally acceptable principles for debris mitigation. In June 2007, at its 62nd session, the STSC member nations endorsed the Space Debris Mitigation Guidelines¹⁰⁸. In 2008, the COPUOS and General Assembly also supported these guidelines.¹⁰⁹ The guidelines are designed to evolve and the document is expected to be updated according to the development of space activities and their influence on the space environment.

Simultaneously, since the mid-1990's, space agencies in Europe have worked on more technically-oriented guidelines, the "European Code of Conduct" for space debris mitigation, that comply with the IADC and UN guidelines, signed in 2006 by the Italian Space Agency (ASI), British National Space Centre (BNSC), French Space Agency (CNES), German Space Agency (DLR) and ESA. In this connection, ESA developed its own "Requirements on Space Debris Mitigation for Agency Projects"¹¹⁰ that have been in force since April 2008. They pertain to all future procurements

¹⁰⁶ Johnson, Nicholas L. "Space debris mitigation strategies and practices in geosynchronous transfer orbits." *Advances in Space Research* 35.7 (2005).

¹⁰⁷ Johnson, Nicholas L. "Developments in space debris mitigation policy and practices." *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*. 221.6 (2007): 907.

¹⁰⁸ United Nations General Assembly. Report of the Committee on the Peaceful Uses of Outer Space on its fiftieth session Session, Held in Vienna from 6 to 15 June 2007. UN Doc. A/62/20. Vienna: United Nations.

¹⁰⁹ United Nations General Assembly. Resolution adopted by the General Assembly entitled "International cooperation in the peaceful uses of outer space" of 22 Dec. 2007. UN Doc. A/RES/62/217 of 1 Feb. 2008. New York: United Nations.

¹¹⁰ ESA Director General's Office: Requirements on Space Debris Mitigation for ESA Projects. ESA Doc. ESA/ADMIN/IPOL(2008)2 Annex 1 of 1 Apr. 2008. Paris: European Space Agency.

of space systems (launchers, satellites, and inhabited objects).¹¹¹

One of major concerns with regard to space debris, beyond the intentional destruction of satellites by ASAT weapons, is collisions. *The 1972 Incidents at Sea Agreement* between the U.S. and USSR is often referenced as a document from which important lessons could be drawn for collision-avoidance TCBMs and was the original foundation for Stimson Center's efforts to advance a code of conduct. The Agreement provides for implementation of a variety of procedures so as to avoid dangerous close quarter incidents at sea. The motivation for compliance was said to be strengthened by understanding the consequences of failure to abide by the agreed terms. It is cited as an example of the right mix of military and diplomatic tools in reducing significantly the risk of unintentional escalation. By the 1980's, the frequency of incidents decreased from what they were in the 1960's and 1970's.

Useful TCBMs to draw on when configuring those for space include:

- A requirement to instruct the commanding officers of their respective ships to observe strictly the letter and spirit of the International Regulations for Preventing Collisions at Sea, referred to as the Rules of the Road (Article II)
- A requirement for ships, meeting or operating in the vicinity of a formation of the other Party, to observe the Rules of the Road as well as avoid manoeuvring in a manner which would hinder the evolution of the formation. (Article III.2)
- A requirement for ships conducting surveillance on other ships to stay at such distance as to avoid the risk of collision and avoid executing manoeuvres that would endanger the ships under surveillance (Article III.4)
- Non-simulation of attacks by ships via aiming guns, missile launchers, etc. in the direction of a passing ship of the other Party, not launching any object in the direction of passing ships of the other Party, or illuminating the navigation bridges.

The agreement also provides for:

- notice of three to five days in advance, as a rule, of any projected actions that

¹¹¹ "International cooperation – Regulations & treaties." 20 Feb. 2009. ESA. 21 July 2010. <http://www.esa.int/esaMI/Space_Debris/SEMQL05VQF_0.html>.



might 'represent a danger to navigation or to aircraft in flight';

- information on incidents to be channelled through naval attaches assigned to the respective capitals; and
- annual meetings to review the implementation of the Agreement.

Best Practices Guidelines

In the late 1980's, the U.S. and Europe began to discuss long-term hazards to space, including the issue of Earth orbiting debris. Other countries, including Japan and Russia, later joined the debate. One of the outcomes was the establishment of the Inter-Agency Space Debris Coordination Committee (IADC) referenced above. Encouraged by the endorsement of the IADC debris mitigation guidelines by the UN COPUOS and UN General Assembly, an informal working group (comprised of experts from public as well as private space sector) is seeking to configure "best practices" in this issue area. Such practices are designed to ensure the "long-term sustainability" of space activities. The working group was established through the efforts of then-Chairman of COPUOS, Gérard Brachet, and met for the first time in Paris in February 2008.¹¹² In June 2010, the working group presented, during the 53rd session of the UN COPUOS, a working paper containing proposed terms of reference, method of work and work plan concerning "the Long-term Sustainability of Outer Space Activities of the STSC".¹¹³ The envisioned product is a report to be published in 2014 addressing "best practices, operating procedures, technical standards and policies associated with the safe conduct of space operations" as well as a set of voluntary guidelines.¹¹⁴

Advancing the Safety of Space Activities

There have likewise been proposals for an International Civil Aviation Organization (ICAO) for space. The "terrestrial" ICAO established in 1944, also known as the Chicago Convention, placed international airspace under the authority of ICAO. As the International Association for the Advancement of Space Safety (IAASS) suggests, many critical

systems used for aviation will be based in space (e.g. traffic control, digital aviation communications, etc.). Accordingly, there will be greater need for the improved management of space traffic.¹¹⁵ In this connection, the IAASS provided a six-point manifesto the goal of which is to advance the safety of space activities¹¹⁶. They involve:

1. Equally protect the citizens of all nations from the risks posed by launching, over flying, and re-entering of space systems;
2. Develop, build and operate space systems in accordance with common ground and flight safety rules, procedures and standards based on the status of knowledge and the accumulated experience of all space-faring nations;
3. Establish international traffic control rules for launch, on-orbit and re-entry operations to prevent collisions or interference with other space systems and with air traffic;
4. Protect the ground, air and space environments from chemical, radioactive and debris contamination related to space operations;
5. Ban intentional destruction of any on-orbit space system or other harmful activities that pose safety and environmental risks; and
6. Establish mutual aid provisions for space mission emergencies.

Space Traffic Management (STM)

One major proposal for future space management would create some means for administering orbital debris control, collision avoidance and radio frequency interference in a comprehensive manner. This concept was discussed at length in the 2006 International Academy of Astronautics report prepared by a working group on STM.¹¹⁷ This concept is defined as: a set of technical and regulatory provisions for promoting safe access to, operations in, and return from outer space to

¹¹² United Nations General Assembly. Committee on the Peaceful Uses of Outer Space. Working paper submitted by France at the Scientific and Technical Subcommittee on its forty-seventh session. Held in Vienna from 8–19 February 2010. UN Doc. A/AC.105/C.1/L.303 of 9 February 2010. Vienna: United Nations.

¹¹³ United Nations General Assembly. Committee on the Peaceful Uses of Outer Space. Report of the Scientific and Technical Subcommittee on its forty-seventh session. Held in Vienna from 9–18 June 2010. UN Doc. A/AC.105/L.277 of 8 June 2010. Vienna: United Nations.

¹¹⁴ *Ibid.*: 3.

¹¹⁵ "Manifesto for Safe and Sustainable Outer Space". 09 Sep. 2009. International Association for the Advancement of Space Safety. 21 July 2010. <<http://espi.or.at/images/stories/dokumente/leaflet/manifes-to%20-%2015092009.pdf>>: 8.

¹¹⁶ "Manifesto for Safe and Sustainable Outer Space". 09 Sep. 2009. International Association for the Advancement of Space Safety. 21 July 2010. <<http://espi.or.at/images/stories/dokumente/leaflet/manifes-to%20-%2015092009.pdf>>.

¹¹⁷ Contant-Jorgenson, Corinne, Petr Lála and Kai-Uwe Schrogl, eds. *Cosmic Study on Space Traffic Management*. Paris: International Academy of Astronautics, 2006.

Earth free from physical and radiofrequency interference. "Traffic" in space has received attention since the 1980's and was treated in workshops convened by the American Institute of Aeronautics and Astronautics (AIAA) in early 2000.¹¹⁸

Space operations today are, for the most part, managed separately by individual states, through the ITU and bottom-up efforts like the Inter-Agency Space Debris Coordination Committee (IADC), the Committee on Earth Observation Satellites (CEOS), and private operators' initiatives (e.g. Space Data Association). The STM concept emphasises the need to preserve long-term continuity of keeping space secure and respond to fast-breaking space events and the actors involved. This could be accomplished by creating a regime which addresses all aspects of space activities. The inevitable overlap that such an exercise would witness could be crafted to strengthen the prototype system developed.¹¹⁹

Ottawa Convention (Treaty)

In 2001, the Acronym Institute's Rebecca Johnson proposed, as a means of restricting the deployment and use of space weapons, a space version of the "Ottawa process" that pertained to the ban on anti-personnel landmines signed in 1997. As mentioned in Chapter 2, the Ottawa Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines (APL) and on their Destruction that entered into force in 1999 was driven by smaller countries and civil society organisations. It has not been recognised, despite its high number of signatories, by major countries like the U.S., India, Pakistan, Russia or China.

What is interesting to note is that most of the large EU states (except Germany) initially opposed EU's involvement in the Convention. Ultimately, the EU became active in efforts to universalise the Treaty, despite the fact that the EC is not a party to the treaty. Accordingly, Member States (MS) were not unanimous with regard to the Ottawa Convention. Nevertheless, the EU welcomed its adoption. In 2003, an expert group of officials from the Commission and MS was created to help steer foreign policy on APLs. In 2004, the EC together with the MS began to organise joint field missions to recipient countries. Although

¹¹⁸ Schrogl, Kai-Uwe. "Space Traffic Management: The New Comprehensive Approach For Regulating the Use of Outer Space – Results from the 2006 IAA Cosmic Study." *Acta Astronautica* 62 (2008). 273.

¹¹⁹ Schrogl, Kai-Uwe. "Space Traffic Management: The New Comprehensive Approach For Regulating the Use of Outer Space – Results from the 2006 IAA Cosmic Study." *Acta Astronautica* 62 (2008). 274.

the budget for APLs was reduced from \$83.7 million in 2006 to \$45.5 million in 2007 (which decreased the EU's capacity to promote the mine issues in less-interested countries), the EU established a strong APL policy influencing the international regime on this issue.¹²⁰ This example could be useful when assessing how the draft EU Code of Conduct could be institutionally treated in Europe.

Commercial Dimensions

In addition to governmental efforts, there likewise exist commercial initiatives to deal with threats to safe and secure space operations. The most prominent is the establishment of the *Space Data Association* (SDA) initiated by Intelsat, SES and Inmarsat, together with other satellite operators.¹²¹ Their main goal is to address the issues of reducing the threat of collisions and radiofrequency interference in GEO. Unintentional interference costs commercial operators millions of dollars annually due to revenue losses and requirement to track down the source of interference.¹²² The SDA is supported by the Satellite Users Interference Reduction Group (SUIRG) that seeks to identify and mitigate satellite interference problems and its impact on the industry.¹²³ Another private sector initiative is the working committee International Satellite Operations Group (ISOG) of the World Broadcasting Unions (WBU).

The authority in charge of allocating the GEO slots and international coordination of the RF spectrum is the ITU. The use of RF spectrum is managed by individual countries, but conforming to ITU allocations. The ITU Member States regulate orbit and spectrum usage via its ITU Constitution and Convention, including its Radio Regulations (RR). The RR is a binding international treaty. Accordingly, the ITU regulations are an independent legal regime, although embedded in the UN Treaties and Principles. The emphasis of the ITU-regulated space activities has been on efficient, rational, and cost-effective utilisation through a "first come first serve" principle.¹²⁴ Although the ITU Convention protects civilian satellites

¹²⁰ Cosa, Oriol. "The Unexpected EU Leadership on Landmines: The Influence of the Ottawa Convention on the EU." *European Security* 18.3 (2009). 254.

¹²¹ Intelsat and SES account for about 50 percent of the global fixed-satellite services business worldwide. Together with Eutelsat and Telesat of Canada, the figure exceeds 75 percent.

¹²² de Selding, Peter B. "Satellite Operators to Create Database to Combat Interference." *Space News* 2 Nov. 2009.

¹²³ "Who We Are." *Space Users Interference Reduction Group*. 21 July 2010. <<http://www.suirg.org/aboutus.shtml>>.

¹²⁴ Henri, Yvon. "Orbit/Spectrum Allocation Procedures, Registration Mechanism." *Biennial Radiocommunication Seminar*. 30 Oct. to 3 Nov. 2006, Geneva, Switzerland.



from interference, it does not address overall space security.

3.2 Threats to Space Security Necessitating Use of TCBMs

By early 1960s, both American and Soviet leaders recognised that space is fragile and not suitable for a potential arms race. After a number of nuclear tests in space, both powers realised the adverse effects of electromagnetic pulse (EMP) radiation from nuclear explosions in space on satellites. Although no permanent cooperative regime was established, both countries took meaningful diplomatic steps to ensure space stability, by signing binding Treaties pertaining to space. They did so despite the strategic risks. However, new and emerging space actors may not have come to this recognition. The asymmetric nature of space vulnerability is compounded by a number of factors. Among these are environmental threats (including orbital debris and space weather¹²⁵), crowding of geostationary orbit, limited radio-frequency spectrum availability, and man-induced threats, such as the use of ASAT systems.

Orbital Debris

Objects in space remain in orbit for some period of time or permanently and travel at a speed of about 27,000 km per hour (unlike air and sea environments where abandoned or destroyed objects fall down or sink to the sea bottom). The accumulation of space debris has been caused by a number of factors, including abandoned satellites and other objects launched to space; intentional release of various components of spacecraft (e.g. the used stages of rockets); intentional destruction of an object in space (e.g. via an ASAT test) and explosions of old and unstable spacecraft. Small pieces are difficult to track given the demand on, and the current status of, technology, making them in some ways more dangerous than larger objects. Although smaller pieces in certain altitudes can burn up in the atmosphere, those flying some 880 km above Earth's surface will stay there for decades, above 1,000 km for centuries and above 1,500 km likely forever.¹²⁶ Natu-

¹²⁵ Space weather involves radiation from a number of varying conditions on the sun plus galactic cosmic rays that have potential serious effects on electronic systems and on human beings. (Ibid: 8).

¹²⁶ Primack, Joel R. "Debris and Future Space Activities." Ed. James Clay Moltz. *Future Security in Space: Commercial, military, and arms control trade-offs*. Occasional

rally, they do not only endanger satellites, but also manned missions.

The U.S. SSN currently tracks about 1,000 active satellites and 20,000 pieces of orbital debris (including inactive satellites) through a ground-based network of radar and optical telescopes around the world. The smallest objects now tracked are about 10 cm large.¹²⁷ All debris needs to be catalogued and observed on a continual basis and space objects must be manoeuvred in the event that a close approach is detected. The ISS, for example, has to be moved if there is a 1-in-10,000 chance of an object hitting the orbiting laboratory.¹²⁸

A number of events catalysed the view of the U.S. government and other major space-faring nations that more needs to be done in the area of improving space situational awareness (SSA) to manage collision avoidance. These included: the 2007 China ASAT test; the February 2009 Iridium/Cosmos collision; and the May 2010 case of an out-of-control Intelsat-Galaxy 15 satellite. As the U.S. Department of Defense's interim Space Posture Review stated, space is "increasingly congested and contested".¹²⁹

In January 2007, China used a direct-ascent, kinetic-kill ASAT missile launched from its Xichang Space Center in Sichuan province to intercept its inactive weather satellite, *Feng Yun 1C* (FY-1C). Ground-based radars guided the launch vehicle with a warhead to its target which was intercepted at an altitude of 865 km (537 miles).

This high-altitude intercept caused a large debris field. By way of comparison, in 1985, the U.S. Air Force conducted an ASAT weapons test against an American satellite by a missile launched from an F-15 aircraft. The equivalent of one-ton of kinetic energy produced over 250 pieces of trackable debris, one of which came within one mile of the international space station fourteen years

Paper 10.18. Southampton: Monterey Institute of International Studies, 2002.

¹²⁷ Elliot, Dan. "U.S. satellite launches July 8 to monitor debris in Earth orbit." 06 July 2010. USA Today. 21 July 2010.

<http://www.usatoday.com/tech/science/space/2010-07-06-debris-monitoring-satellite_N.htm>.

¹²⁸ Malik, Tarig. "Space Junk Threats Invisible to Astronauts in Orbit." 10 Apr. 2010. Space.com. 15 July 2010. <<http://www.space.com/missionlaunches/space-junk-astronaut-threat-100410.html>>.

¹²⁹ Tirone, Jonathan. "Satellite-Killing Space Junk Risks \$250 Billion Market, TV." 25 May 2010. Bloomberg. 21 July 2010. <<http://www.bloomberg.com/news/2010-05-25/satellite-killing-junk-risks-250-billion-space-market-ahead-of-world-cup.html>>.

later in 1999.¹³⁰ It took some 17 years for that debris field to completely deorbit.¹³¹

China's 2007 ASAT test created a vastly larger amount of debris. Experts estimate it will take roughly a century for this constellation of approximately 40,000 pieces of space debris to clear out of Low Earth Orbit (LEO). The debris created by the 2007 ASAT test alone could damage some 700 spacecraft over the next two decades.¹³² The problem is aggravated by the threat of "cascading" debris produced by collisions of individual fragments and increasing the overall constellation of orbital debris.

Other events occurred in 2007, such as creation of debris by the second stage of the Japanese H-2A rocket body launched in September 2006, NASA's retired Upper Atmosphere Research Satellite (UARS) and the second stage of the Delta IV launch vehicle. In 2008, it was, for example, debris from the Cosmos 2105 satellite, third-stage of the CZ-3A launch vehicle (launched in October 2007), final stage of the Molniya-M launch vehicle (launched in August 1994), Cosmos 2421 satellite, and an Atlas 5 upper stage.¹³³

Weapons/Missile Proliferation

As described in the previous section, kinetic energy (KE) ASAT weapons, by destroying objects in space, can increase the orbital debris population. Given rapid technological advances, it is often difficult, if not impossible, to differentiate between military and civilian/commercial launch vehicles, as a number of the technologies and equipment employed are similar or identical.¹³⁴ The "dual-use" character of these space-related capabilities is evident when comparing them to those required for long-range ballistic missiles. For example, the Soviet Union's Sputnik and the U.S. Explorer 1 were both placed in orbit by modified ballistic missiles.¹³⁵ Inter-

mediate-range ballistic missiles (IRBM) can also serve as the first stage of a space launch vehicle. To illustrate this point, the Delta family of launch vehicles originated from the Thor IRBM designed to carry a thermonuclear warhead up to 1,500 miles.¹³⁶

The first two stages of the Taepodong-1, tested by North Korea in August 1998 as a space launcher, are said to be Nodong and Hwasong-6 missiles, respectively. North Korea owes, in large part, the genesis and advancement of its missile programme, to China. Other countries, notably Pakistan, have been relying on North Korea for most of its missile technology.¹³⁷ As Lt. Gen. Henry A. Obering III, former Director of the Missile Defense Agency, pointed out, North Korea's April 2009 Taepodong-2 launch served as an advertisement for North Korea's missile programme, and could lead to additional proliferation of longer-range missile components and technology.¹³⁸ North Korea has sold Nodong missiles to countries such as Pakistan and Iran, contributing to the development of Pakistan's Ghauri missile as well as Iran's Shahab-2 and Shabab-3 missiles.¹³⁹ The modified Shahab-3 served, in turn, as the first stage of the Iranian Safir-2 space launcher tested in February 2008.¹⁴⁰

Launch vehicles can likewise be derived from intercontinental ballistic missile (ICBM) programmes as was the case with the Soviet Proton rocket, originally designed to carry a nuclear warhead that is now used for heavy lifts into orbit.¹⁴¹ Other ICBMs had been modified to serve as launch vehicles as well, like the case of the American Atlas and Titan ICBMs or a modified version of the Soviet SS-18 ICBM that now serves as the Dnepr-1 space launch vehicle.¹⁴² In short, a rocket designed to carry a satellite or space vehicle

¹³⁰ Lieggi, Stephanie C. "Space Arms Race: China's ASAT Test a Wake-up Call." 24 Jan. 2007. James Martin Center for Nonproliferation Studies. 21 Nov. 2008.

<<http://cns.miis.edu/stories/070124.htm>>.
¹³¹ Pollpeter, Kevin. "Motives and Implications Behind China's ASAT Test." 24 Jan. 2007. China Brief, The Jamestown Foundation. 20 Nov. 2008.
<http://www.jamestown.org/news_details.php?news_id=216>

¹³² Kan, Shirley. "China's Anti-Satellite Weapon Test." 23 Apr. 2007. CRS Report to Congress. 21 July 2010.
<<http://www.fas.org/sgp/crs/row/RS22652.pdf>>: 2.

¹³³ Schrogl, Kai-Uwe et. al., eds. "Yearbook on Space Policy 2007/2008: From Policies to Programmes." Vienna: SpringerWienNewYork (2009). 56.

¹³⁴ "Missile Defense, Space Relationship & the Twenty-First Century." Cambridge, Washington: The Institute For Foreign Policy Analysis, 2009. 19.

¹³⁵ Rubin, Uzi. "America's New Space Rivals: Iran, North Korea Swoop To Conquer," The Washington Times, 20 Mar. 2009. A15.

¹³⁶ "Evolved Expandable Launch Vehicle." Air Force Space Command. 21 July 2010.

<<http://www.afspc.af.mil/library/factsheets/factsheet.asp?id=3643>>.

¹³⁷ Barnes, Julian E. and Greg Miller. "N. Korea Launch Raises Concerns Rocket Failed, But Showed Progress." Pittsburgh Post-Gazette 6 April 2009: A1.

¹³⁸ Ibid.

¹³⁹ "North Korea's Taepodong and Unha Missiles." Federation of American Scientists. 26 April 2009.

<<http://www.fas.org/programs/ssp/nukes/nuclearweapons/Taepodong.html>>.

¹⁴⁰ Crail, Peter. "Iran Makes First Successful Space Launch." Arms Control Today 39.2 (2009): 42.

¹⁴¹ Sietzen, Frank. "Proton: Nucleus of Russia's Space." 06 July 2010. *Space.com* 12 March 2009.
<http://www.space.com/news/spacehistory/proton_history_000707.html>.

¹⁴² Weeden, Brian. "A Space Launch Vehicle By Other Name..." 09 Mar. 2009. *The Space Review*. 11 Mar. 2010.
<<http://www.thespacereview.com/article/1323/1>>.



into orbit can be readily modified to carry warheads and vice versa.¹⁴³

Today, both North Korea and Iran are actively pursuing nuclear weapons programmes as well as chemical and biological weapons. Iran, which owes its missile programme largely to Pyongyang, is seeking the technology to increase the range of its Shabab missiles. Russia and China, both exporters of their missiles, are continuously improving their delivery systems and the precision of their warheads (e.g. the Russian Topol, and China's Dong-Feng 31). Other countries are beneficiaries of these programmes as well. For example, in the early 1990's, Pakistan received missiles from both China (i.e. M-11 missiles, the solid-fuel version of the Scud-B) and North Korea (i.e. liquid-fuel Nodong missiles).

The increased number of China's orbiting satellites points to its improved launch capabilities. The PRC has different types of space launch vehicles associated with its Long March Series, together with three launch facilities¹⁴⁴.¹⁴⁵ China has likewise developed a mobile launch capability, the solid fuel rocket *Pioneer-1* (KT-1).¹⁴⁶ The KT-1 can carry satellites that weigh less than 100 kg, while the KT-2 can carry up to three 100 kg payloads or one 400 kg payload.¹⁴⁷ China began work on a new generation of launch vehicles in 2001 that are said to become operational between 2011 and 2015.¹⁴⁸

The proliferation of ballistic missiles poses a major security threat in the 21st century. This is especially true as these missiles can be equipped with weapons of mass destruction (WMD) warheads. After the fall of the Soviet Union, the proliferation of delivery systems, as well as WMDs themselves, has accelerated, including not only blue prints and components, but fully assembled missiles. In

2001, Thomas Henriksen, Senior Fellow at the Stanford University's Hoover Institution, succinctly described the post-Cold War era: "Unlike the neat symmetry of the Cold War nuclear standoff between the United States and the Soviet Union, today's security environment is a crazy quilt of 'proliferators' and weapons-amassing states".

According to the 2005 Congressional "Missile Survey", fifteen countries produce ballistic missiles and several other have the required capability, but have, thus far, chosen not to do so. Moreover, some thirty-six countries have been identified as possessing ballistic missiles.¹⁴⁹ It is possible that certain countries might be encouraged to use ostensibly peaceful space activities to conceal their missile development programmes as a strengthened capability to launch an object into space can be directly applicable to ballistic missile advances.

In addition to the ground-based KE ASATs, other ASAT systems involve space mines, directed energy weapons like lasers, particle beams and microwaves, and orbital ASATs. Indeed, any manoeuvrable spacecraft without a dedicated payload could constitute an ASAT weapon.¹⁵⁰ The spacecraft could push the target off its orbit, or deliberately crash into it. The satellite could also "employ electronic jamming or laser blinding devices, release explosives, chemicals or radioactive materials."¹⁵¹ These kinds of precision encounters require very accurate orbital data and demanding trajectory calculations.

Space mines are manoeuvrable spacecraft with the sole objective of destroying an adversary's satellite. When approaching the target, an explosive charge is detonated. It can utilise conventional explosives, emission of projectiles (single missiles or buckshot) or nuclear explosives. The space mine can target a single satellite or multiple targets. A debris-creating space mine could, under certain circumstances, devastate an entire orbit¹⁵². Space mines can be deployed secretly

¹⁴³ Rubin, Uzi. "America's New Space Rivals: Iran, North Korea Swoop To Conquer," *The Washington Times*, 20 Mar. 2009. A15.

¹⁴⁴ The three launch sites are: Jiquan Satellite Launch Center in Gansu Province for launching recoverable satellites (including manned spacecraft), Xichang Satellite Launch Center in Sichuan Province for launching satellites into geostationary orbit, and Taiyuan Satellite Launch Center in Shanxi Province for launching polar-orbit satellites.

¹⁴⁵ Pollpeter, Kevin. "Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the U.S. Response." *Carlisle: The Strategic Studies Institute*, 2008. 27-28.

¹⁴⁶ "2008 Report to Congress of the US-China Economic and Security Review Commission." *Washington: US Government Printing Office*, 2008. 158.

¹⁴⁷ Pollpeter, Kevin. "Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the U.S. Response." *Carlisle: The Strategic Studies Institute*, 2008. 8-9.

¹⁴⁸ *Ibid.*: 7.

¹⁴⁹ Feickert, Andrew. "Missile Survey: Ballistic and Cruise Missiles of Selected Foreign Countries." *Washington DC: Congressional Research Service of the U.S. Library of Congress*. 05 July 2010.

<<http://www.fas.org/sgp/crs/weapons/RL30427.pdf>>: 4.

¹⁵⁰ O'Hanlon, Michael E. "Arms Control In Space." *Neither Star Wars Nor Sanctuary: Constraining the Military Uses of Space*. *The Brookings Institution: Washington DC*, 2004. 115.

¹⁵¹ Hagen, Regina and Jürgen Scheffran. "Is a Space Weapons Ban Feasible? Thoughts on Technology and Verification of Arms Control in Space." *Disarmament Forum: Making Space for Security?* Ed. Kerstin Vignard. *Geneva: UNIDIR*, 2003. 43.

¹⁵² *Ibid.*: 44.

in a spacecraft, along with other mission items, making them covert ASATs.¹⁵³

Directed energy weapons like lasers and microwaves can be an attractive weapon of choice. The beams reach their targets instantly, as they travel at the speed of light, and the power directed at a target can be modified to produce temporary and reversible effects or permanent damage.¹⁵⁴ Lasers are well-suited to directed energy attacks because they can emit large amounts of energy in a narrow beam and frequency band. Laser technology is mature, and a variety of laser technologies with different ranges and power levels have already been developed. Lasers can be divided into two basic categories: continuous wave lasers and pulsed lasers¹⁵⁵. An ASAT laser can be ground- or sea-based, airborne or space-based. Lasers can accomplish different ASAT assignments. Beyond overloading electronic systems, causing physical damage and/or overheating specific, vulnerable components, spacecraft can be dazzled and/or blinded (partially or completely)¹⁵⁶. Particle beam weapons are directed energy weapons that use high-energy beams of atoms or electrons to inflict damage to the targeted satellite.

Besides laser and particle beam weapons, high-powered microwaves can be used for directed energy ASAT weapons. High intensity microwave emissions can disrupt spacecraft electronics or even permanently damage them: "In a non-destructive attack, the microwaves may, for example, reset computers and garble commands, disrupting the satellite's function during the attack and for a time after."¹⁵⁷

¹⁵³ Wright, David, Laura Grego and Lisbeth Gronlund. "The Physics of Space Security: A Reference Manual." Cambridge (MA): American Academy of Sciences, 2005: 152.

¹⁵⁴ Ibid.: 123.

Similar reasoning in: Hagen, Regina and Jürgen Scheffran. "Is a Space Weapons Ban Feasible? Thoughts on Technology and Verification of Arms Control in Space." Disarmament Forum: Making Space for Security? Ed. Kerstin Vignard. Geneva: UNIDIR, 2003. 47.

¹⁵⁵ Continuous wave lasers produce power continuously whereas pulsed lasers produce power in short, repeated bursts. Op. Cit. Wright, David, Laura Grego and Lisbeth Gronlund. "The Physics of Space Security: A Reference Manual." Cambridge (MA): American Academy of Sciences, 2005: 124.

¹⁵⁶ Hagen, Regina and Jürgen Scheffran. "Is a Space Weapons Ban Feasible? Thoughts on Technology and Verification of Arms Control in Space." Disarmament Forum: Making Space for Security? Ed. Kerstin Vignard. Geneva: UNIDIR, 2003. 47; Wright, David, Laura Grego and Lisbeth Gronlund. "The Physics of Space Security: A Reference Manual." Cambridge (MA): American Academy of Sciences, 2005: 125-130.

¹⁵⁷ Wright, David, Laura Grego and Lisbeth Gronlund. "The Physics of Space Security: A Reference Man-

Electromagnetic Pulse (EMP) in Space

The EMP radiation from nuclear explosions in space strikes everything within the line of sight and can severely damage or disable nearby satellites. The ionosphere traps EMP radiation which dissipates very gradually. Such an explosion creates a "persistent radiation environment that slowly damages unshielded satellites."¹⁵⁸ When nuclear weapons were tested in space during early 1960's, the U.S., Soviet, and British communications and reconnaissance satellites then in LEO were significantly harmed.¹⁵⁹ In short, an EMP attack would constitute "a highly effective terrorist-style attack by a country having a nuclear weapon and a medium-range missile to launch it."¹⁶⁰ The testing of nuclear weapons in space was banned by the 1963 Limited Test Ban Treaty (LTBT) and the placement of WMD's by the 1967 Outer Space Treaty (OST).

Jamming and Spoofing

A temporary denial of the enemies' use of space assets can be accomplished via jamming the communication link between a satellite and the ground segment. Jamming is "transmitting a high-power electronic signal that causes the bit error in a satellite's uplink or downlink signals to increase, resulting in the satellite or ground station losing lock". If jamming is temporary, it may be difficult to identify its source to possibly retaliate. Spoofing refers to "taking over a space system by appearing as an authorized user". For successful spoofing, the power of the spoofed signal must be almost identical to that of the true signal. "If it is stronger, then the receiver will be jammed rather than spoofed, if it is weaker, the receiver will ignore the spoofed signal in favour of the true signal."¹⁶¹ A special case of spoofing is an unauthorized usage of a vacant transponder.¹⁶²

Jamming and spoofing can be further categorized depending on whether the target is the downlink or uplink. In the downlink case, the usable signal is blocked and cannot reach the ground station. When spoofing, the ground

ual." Cambridge (MA): American Academy of Sciences, 2005: 131.

¹⁵⁸ Ibid.: 138.

¹⁵⁹ Moltz, James Clay. "Space and Environmental Security." The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests. Stanford, CA: Stanford University Press, 2008. 51.

¹⁶⁰ Wright, David, Laura Grego and Lisbeth Gronlund. "The Physics of Space Security: A Reference Manual." Cambridge (MA): American Academy of Sciences, 2005: 139.

¹⁶¹ Ibid.: 118.

¹⁶² Black, Samuel. "No Harmful Interference with Space Objects: The Key to Confidence-Building." Stimson Center Report 69 (2008): 7.



station still receives a usable, but false signal. The employment of a jammer or spoofer is relatively easy and inexpensive. Moreover, homemade GPS jammer instructions, for example, are available on the internet. Downlink jamming can be countered by an anti-jamming technology. For example, the signal can be encoded to prevent jamming, or the ground station may be designed to receive signals only from the direction of the transmitting satellites¹⁶³. Another option is to have “the satellite concentrate its power in a small frequency band and the receiver filter out all other frequencies. If the jammer does not know what frequency the system is using, it must spread its power over a much broader range of frequencies to make sure it covers the frequency that is actually being used.”¹⁶⁴ To counter spoofing, the signal can be encrypted¹⁶⁵. Jamming or spoofing the uplink means preventing the signal from being picked up by the satellite receivers. The uplinks are usually well-protected by encoding and/or encrypting the signal¹⁶⁶. Nonetheless, “high-power jammers can defeat the protection provided by encoding by essentially creating too much noise to sort through.”¹⁶⁷ Commercial broadcasting and telecommunications satellites are more vulnerable than military satellites, because the latter may encode or encrypt their signal before retransmission¹⁶⁸.

In 2007, for example, satellite TV jamming was reported in Israel and Lebanon without the source of the interference being detected.¹⁶⁹ Recently, Iran was deliberately jamming satellite transmissions carrying broadcasts of the BBC, Deutsche Welle (DW) and Voice of America (VoA) to its country. Accordingly, Eutelsat was unable to conduct normal and licensed satellite operations that deliver these services to Iran. This occurred despite the fact that Iran is both a member of the UN and the ITU and as such is obligated to abide by Article 45 of the ITU which states that, among other items, “the Member States recognize the necessity of taking all practicable steps to prevent the operation of electrical apparatus and installations of all kinds from causing harmful interference to the radio services”. The fact that Mr. Ahmad Talebzadeh, Iran’s Deputy Minister of Information

¹⁶³ Wright, David, Laura Grego and Lisbeth Gronlund. “The Physics of Space Security: A Reference Manual.” Cambridge (MA): American Academy of Sciences, 2005: 119-120.

¹⁶⁴ Ibid: 120.

¹⁶⁵ Ibid.

¹⁶⁶ Ibid.: 121.

¹⁶⁷ Ibid.

¹⁶⁸ Ibid.

¹⁶⁹ Schrogl, Kai-Uwe et. al., eds. “Yearbook on Space Policy 2007/2008: From Policies to Programmes.” Vienna: SpringerWienNewYork (2009). 56.

and Communication Technology, serves as the current Chairman of the UN legal sub-committee of the UN COPUOS, makes this event even more troubling.¹⁷⁰ This example demonstrates the need to establish the means to enforce ITU rules and regulations as well as penalise violators.

Other Threats

Orbital Crowding and Radio-Frequency (RF) Interference

Three orbits where most spacecraft operate are: low Earth orbit (LEO) at an altitude up to 2,000 km; medium earth orbit (MEO) at an altitude of about 10,000 km¹⁷¹; and geostationary orbit (GEO) at an altitude of approximately 36,000 km. Many imaging satellites, the space shuttle and the ISS fly at LEO and GPS satellites in MEO. GEO is home to most of the large communication satellites (mobile comsats operate in LEO and MEO).¹⁷²

GEO orbit is unique as the satellite occupying this orbit rotates at such speed as to remain at a specific spot over the Earth’s surface. Accordingly, ground antennas do not have to be manoeuvred to receive signals from GEO satellites. Three equally spaced satellites in GEO can provide almost full Earth coverage required for supplying or relaying communication transmissions. The number of available GEO satellite slots has decreased with rising demand, thereby increasing the potential for radiofrequency (RF) spectrum interference since the distances between satellites are getting smaller. The RF spectrum itself is becoming a precious commodity.¹⁷³

The International Telecommunications Union (ITU) is in charge of allocating the GEO slots and international coordination of the RF spectrum. The use of RF spectrum is managed by individual countries, but conforming to ITU allocations. The largest concern of the international community is the equitable sharing

¹⁷⁰ Brown, Peter. “Iranian In a Jam Over Satellite Blocking.” 25 Mar. 2010. Asia Times Online. 26 July 2010. <http://www.atimes.com/atimes/Middle_East/LC25Ak04.html>.

¹⁷¹ MEO is an especially harsh environment due to the Van Allen radiation belts (swirls of radioactive particles potentially damaging to solar cells, integrated circuits, sensors, and humans).

¹⁷² Johnson-Freese, Joan. “Space As a Strategic Asset.” New York: Columbia University Press, 2007. 35.

¹⁷³ The RF spectrum is divided into frequency bands, measured in Hertz and wider bands can transmit more information. Commercial operators usually use C-band (4–8 GHz) and the Ku-band (12–18 GHz). Mobile phones, ship communications and messaging use S-band (2–4 GHz) and the L-band (1–2 GHz). Broadband communications use Ka-band (27–40 GHz) and many U.S. military satellites use the K-band (18–27 GHz) and the X-band (8–12 GHz).

of orbital slots and RF spectrum among both developing and developed countries, as well as among civilian and military users.

Geopolitical Developments

The existing international legal regime for space faces challenges associated with enforcement and verification. With regard to enforcement, the negotiation of binding treaties ended by the beginning of the 1980s. Since then countries have relied on various non-binding UN agreements in principle (e.g. in remote sensing, use of nuclear power sources, debris mitigation, and sharing the benefits of space activities). Concerning verification or adherence to existing Space Treaties and non-binding norms, the main problem lies in the asymmetric distribution of space capabilities, such as SSA. The U.S. possesses the majority of such capabilities and the question remains to what degree the international community is comfortable relying on the U.S. as often the sole source of verification-oriented information.

The overview provided by no means represents a complete list of activities that constitute a threat to safe and secure operations in space. For example, threats of space weather (e.g. solar wind) or near-Earth object (NEO) have not been treated in the text since they are not man-made. The purpose has rather been to showcase potential threats to space operations and underscore the urgency of adopting appropriate measures to advance space security.

3.3 TCBM Options

The UNGA Resolution 1721 (XVI) on "International co-operation in the Peaceful uses of Outer Space" of December 1961, provided the first basis for the governance of international law regarding outer space activities. In 1963, inspired partially by the signing of the Partial Test Ban Treaty (PTBT), a General Assembly resolution was adopted entitled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space" (Resolution 1962 (XVIII)). This laid the groundwork for the main principles governing outer space activities as described in the UN Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST).¹⁷⁴

¹⁷⁴ Hobe, Stephan, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl (eds.). *Cologne Commentary on Space Law; Volume 1; Outer Space Treaty.* Cologne: Carl Heymanns Verlag (2009). 12–13.

The OST was partially inspired by the need to govern activities in space pursuant to the need to legitimise the use of photo intelligence satellites by the U.S. It was adopted by a unanimous vote in the General Assembly (G.A. Resolution 2222). It marked the first effort to establish an institutionalised, multi-lateral framework for space security.¹⁷⁵ As of January 2010, 100 countries had ratified the treaty.¹⁷⁶ The OST establishes outer space as the "province of all mankind", "free for exploration and use by all States", and "not subject to national appropriation". It bans "placement of nuclear weapons or other weapons of mass destruction" in space, emphasises that space is to be used only for "peaceful purposes", and establishes that states are "responsible for national space activities and liable for damage caused by their space objects", and obliged to "avoid harmful contamination of space and celestial bodies".¹⁷⁷

Concerns about the shortcomings of the OST, however, surfaced almost immediately. Although Article 1 of the OST emphasises the right of the free use of space for peaceful purposes, the treaty's preamble commits signatories to promote the "common interest of all mankind" and "friendly relations".¹⁷⁸ The OST merely limits the placement of nuclear weapons in space. It was not to address a ballistic missile, nuclear-equipped or not, that ascends to, and moves through, space, or other scenarios.¹⁷⁹

Scholars like Nancy Gallagher and John Steinbruner propose building on the OST with new rules that would address the current challenges of space security.¹⁸⁰ At this time, there is no consensus within the COPUOS to

¹⁷⁵ Moltz, James Clay. "The Emergence of Cooperative Restraint 1962 – 1975." *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests.* Stanford, CA: Stanford University Press, 2008. 125.

¹⁷⁶ "United Nations Treaties and Principles on Outer Space and Related General Assembly Resolutions." Doc. ST/SPACE/11/ Rev.2/Add.3 of 1 Jan. 2010. United Nations Office for Outer Space Affairs. 26 July 2010. <http://www.oosa.unvienna.org/pdf/publications/ST_SPAC_E_11_Rev2_Add3E.pdf>.

¹⁷⁷ "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." United Nations Office for Outer Space Affairs. 20 Apr. 2009. <<http://www.oosa.unvienna.org/oosa/SpaceLaw/outerspt.html>>.

¹⁷⁸ "Japan Should Seek UNSC Cooperation in Response to N. Korea's Missile Launch." *Mainichi Daily News* 6 Apr. 2009.

¹⁷⁹ Hobe, Stephan, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl (eds.). *Cologne Commentary on Space Law; Volume 1; Outer Space Treaty.* Cologne: Carl Heymanns Verlag (2009). 75–81.

¹⁸⁰ Gallagher, Nancy and John D. Steinbruner. "Foreword." *Reconsidering the Rules for Space Security.* Cambridge: American Academy of Arts and Sciences, 2008. vi.



negotiate OST amendments, or establish a new forum to deal with outer space activities. However, there exists some consensus within the COPUOS on a “bottom-up” approach, guidelines based on technical and operational considerations (or “rules of the road”), and respecting the founding principles of the OST in a manner that would contribute to responsible behaviour in space.¹⁸¹ As Dr. Peter Hays points out, however, the current debate is not about acknowledging OST principles, but achieving more universal adherence to the OST regime. This is essential if space TCBMs are to be employed in a meaningful way.¹⁸²

Transparency measures can likewise be adopted on a unilateral basis. An example is provided by the latest U.S. National Space Policy released in June 2010, which emphasises increased cooperation with other states as well as enhanced transparency in national space activities. Moreover, as observed by Lt. Col. Brandon Hart, besides multilateral treaty obligations, states can create TCBM requirements in their national legislation. He cites U.S. legislation 10 USC 2274 on the “Space Situational Awareness Program” which allows, but does not require, the Department of Defense to share data, information and services with both commercial and foreign entities. It states that the Secretary of Defense “may provide space situational awareness services and information to, and may obtain space situational awareness data and information from, non-United States Government entities [...]”.¹⁸³

With regard to multilateral space-related arrangements, suggestions have been made to use the example of the International Code of Conduct Against Ballistic Missile Proliferation (the Hague Code of Conduct) in advancing bottom-up mechanisms for space security. The Hague Code requires, among other items, the signatories to abide by the OST, the Liability and Registration Conventions, as well as to provide: 1) an annual declaration on ballistic missile and space programmes

and policies; and 2) prior notification of missile and space vehicle launches. There are, however, almost an equal number of those that see the convention as a mechanism with structural flaws. These include the fact that despite the large number of subscribing states (including the U.S. and Russia), other relevant actors like China, Iran and North Korea do not participate and thus undermine the credibility of the Hague Code.

Lucia Marta argues, for example, that diminished credibility of the Hague Code is primarily caused by: the fact that it was initiated by Western countries to control exports of missile technologies (through Missile Technology Control Regime); the concern of some emerging space nations that they would be restrained in developing their space programmes and SLVs; and due to the lack of interest of countries not involved in space.¹⁸⁴ Moreover, in 2009, only 13% of the launches by the Hague Code subscribers were pre-notified and did not include any Russian or American launches, displaying a dearth of TCBM usage.¹⁸⁵

As mentioned in sub-chapter 3.1.2., there likewise exist commercial efforts to deal with threats to safe and secure operations in space, including the Space Data Association, the Satellite Users Interference Reduction Group (SUIRG) and others.

Below is a table of select TCBMs as they exist in current international frameworks to provide an overview of their respective missions. Specifically, it draws from the following provisions and guidelines from a number of frameworks including:

- United Nations Treaties (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (the Astronauts Rescue Agreement); Convention on International Liability for Damage Caused by Space Objects (the Liability Convention); Convention on Registration of Objects Launched into Outer Space (the Registration Convention); Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (The Moon Treaty)

¹⁸¹ Brachet, Gerard. “Peace in Space: Building on the Outer Space Treaty.” *Celebrating the Space Age: 50 Years of Space Technology, 40 Years of the Outer Space Treaty*. Conference Report 2–3 Apr. 2007. Geneva: UNIDIR. 69–71.

¹⁸² Hays, Peter L. “Developing Agile and Adaptive Space transparency and Confidence-Building Measures.” Eds. Jana Robinson et al. *Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security*. ESPI Report 27. Vienna: European Space Policy Institute (2010).

¹⁸³ Hart, Brandon L. “Transparency & Confidence Building Measures: Treaties, National Legislation, National Policies, and Proposals for Non-Binding Measures.” Eds. Jana Robinson et al. *Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security*. ESPI Report 27. Vienna: European Space Policy Institute (2010).

¹⁸⁴ Marta, Lucia. “The Hague Code of Conduct Against Ballistic Missile Proliferation: ‘Lessons Learned’ for the EU Draft Code of Conduct for Outer Space Activities.” *ESPI Perspectives* 34 (2010): 3.

¹⁸⁵ *Ibid*: 4.

- Principles adopted by the UN General Assembly (Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space; Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting; Principles Relating to Remote Sensing of the Earth from Outer Space Principles Relevant to the Use of Nuclear Power Sources in Outer Space; and Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking

into Particular Account the Needs of Developing Countries)

- Other resolutions adopted by the General Assembly (Resolutions 1721 A and B (XVI) of 20 December 1961 on International Cooperation in the Peaceful Uses of Outer Space; Resolution 1962 (XVIII); Resolution 47/68; Resolution 51/122; Resolution 59/115; Resolution 62/101; and Resolution 62/217)

The table is further augmented by TCBMs put forth in new proposals for organising, managing and regulating space activities as described in Chapter 3.1. (see Table 3 below).

Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
Transparency Measures	<p>"The exploration and use of outer space, ... , shall be carried out for the benefit and in the interests of all countries," (OST, Art. 1)</p> <p>"... States shall facilitate and encourage international cooperation in (free scientific investigation)." (OST, Art. 1)</p> <p>"States Parties to the Treaty shall carry on activities in the exploration and use of outer space, ... , in accordance 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." (OST, Art. 3)</p> <p>"State Parties to the Treaty shall ... render to (astronauts) all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle." (OST, Art 5)</p> <p>"In the exploration and use of outer space, ... , States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, ... , with due regard to the corresponding interests of all other States Parties to the Treaty." (OST, Art. IX)</p> <p>"Each Contracting Party which receives information or discovers that the personnel of a spacecraft have suffered accident or are experiencing conditions of distress or have made an emergency or unintended landing in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any State shall ... : (a) notify the launching authority, or ..., make public announcement; (b) notify the Secretary-General of the UN" (the Astronauts Rescue Agreement, Art. 1)</p> <p>"Each Contracting Party which receives information or discovers that a space object or its component parts has returned to earth in territory under its jurisdiction or on the high seas or any other place not under the jurisdiction of any State, shall notify the launching authority and the Secretary-General of the UN." (The Astronauts Rescue Agreement, Art.</p>	<p>„With a view to facilitate assurance of compliance with the Treaty provisions and to promote transparency and confidence-building in outer space activities the States Parties shall practice on a voluntary basis, unless agreed otherwise, agreed confidence-building measures.“ (PPWT, Art. 6)</p> <p>"We, the undersigned, ... declare the following rights : The right of access to space for exploration or other peaceful purposes; The right of safe and interference-free space operations, including military support functions; The right of self-defense as enumerated in the Charter of the United Nations; The right to be informed on matters pertaining to the objectives and purposes of this Code of Conduct; The right of consultation on matters of concern and the proper implementation of this Code of Conduct." (Stimson Center Code of Conduct)</p> <p>"We, the undersigned, ... declare ... the responsibility to respect the rights of other space-faring states and legitimate stakeholders; the responsibility ... to enhance cooperation on space situational awareness." (The Stimson Center Code of Conduct)</p> <p>"... Safe and Sustainable Outer Space: ... by committing to: 1) Equally protect the citizens of all nations from the risks posed by launching, over-flying, and re-entering of space systems; 2) Develop, build and operate space systems in accordance</p>



Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCMBs	Proposed Space-Related TCMBs
	<p>5)</p> <p>"Each Contracting Party having jurisdiction over the territory on which a space object or its component part has been discovered shall, ... , take such steps as it finds practicable to recover the object or component parts." (The Astronauts Rescue Agreement, Art. 5)</p> <p>"Upon request of launching authority, objects launched into outer space or their component parts found beyond the territorial limits of the launching authority shall be returned to or held at the disposal of representatives of the launching authority, which shall, ... , furnish identifying data prior to their return. " (The Astronauts Rescue Agreement, Art. 5)</p> <p>" ... , a Contracting Party which has a reason to believe that a space object or its component parts discovered un territory under its jurisdiction, or recovered by it elsewhere, is of a hazardous or deleterious nature may so notify the launching authority, which shall immediately take effective steps, under the direction and control of the said Contracting Party, to eliminate possible danger of harm." (The Astronauts Rescue Agreement, Art. 5)</p> <p>"Each State of registry shall furnish ..., as soon as practicable, ... (a) name of launching State of States; (b) an appropriate designator of the space object or its registration number; (c) date and territory or location of launch; (d) basic orbital parameters, including: (i) nodal period; (ii) inclination; (iii) apogee; (iv) perigee; (e) general function of the space object." (The Registration Convention, Art. 4)</p> <p>"Each State of registry shall notify the Secretary-General of the UN, ... of space objects concerning which it has previously transmitted information, and which have been but no longer are in Earth orbit." (The Registration Convention, Art. 4)</p> <p>"Where the application of the provisions of this Convention has not enabled a State Party to identify a space object which has caused damage to it ... , or which may be of a hazardous or deleterious nature, other States, ... in particular States possessing space monitoring and tracking facilities, shall respond to the greatest extent feasible to a request by that State Party, ... , for assistance under equitable and reasonable conditions in the identification of the object. A State Party making such a request shall, to the greatest extent feasible, submit information as to the time, nature and circumstances of the events giving rise to the request." (The Registration Convention, Art. 6)</p> <p>"... States are encouraged, through agreements or other arrangements, to provide for the establishment and operation of data collecting and storage stations, and processing and interpretation facilities, ..." (UNGA Resolution 41/65 on Remote Sensing, Principle 6)</p> <p>"..., States participating in remote sensing activities that have identified processed data and analysed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, shall</p>	<p>with common ground and flight safety rules, procedures and standards based on the status of knowledge and the accumulated experience of all space-faring nations; 3) Establish international traffic control rules for launch, on-orbit and re-entry operations to prevent collisions or interference with other space systems and with air traffic; 4) Protect the ground, air and space environments from chemical, radioactive and debris contamination related to space operations; 5) Ban intentional destruction of any on-orbit space system or other harmful activities that pose safety and environmental risks; and 6) Establish mutual aid provisions for space mission emergencies" (IAASS, Manifesto for safe and Sustainable Outer Space)</p>

Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>transmit such data and information to States concerned as promptly as possible.” (UNGA Resolution 41/65 on Remote Sensing, Principle 11)</p> <p>“As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analysed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms,” (UNGA Resolution 41/65 on Remote Sensing, Principle 12)</p> <p>“International cooperation in the exploration and use of outer space for peaceful purposes shall be conducted in accordance with the provisions of international law, including the Charter of the United Nations It shall be carried out for the benefit and in the interest of all States, irrespective of their degree of economic, social or scientific and technological development, and shall be the province of all mankind. Particular account should be taken of the needs of developing countries. (UNGA Resolution 51/122)</p> <p>“<i>The General Assembly</i> ... recommends that States conducting space activities, ... , consider enacting and implementing national laws authorizing and providing for continuous supervision of the activities in outer space of non-governmental entities under their jurisdiction.” (UNGA Resolution 59/115 on Application of the concept of the “launching State”, Recommendation 1)</p> <p>“The General Assembly ... recommends that the COPUOS invite Member States to submit information on a voluntary basis on their current practices regarding on-orbit transfer of ownership of space objects. (UNGA Resolution 59/115 on Application of the concept of the “launching State”, Recommendation 3)</p> <p>“The General Assembly ... recommends that States consider, ... the possibility of harmonizing (launching state) practices ... with a view to increasing the consistency of national space legislation with international law. (UNGA Resolution 59/115 on Application of the concept of the “launching State”, Recommendation 4)</p> <p>“The General Assembly ... recommends ... that: (a) States that have not yet ratified or acceded to the Registration Convention should become parties to it ...; (b) international intergovernmental organizations conducting space activities (declare their acceptance of the rights and obligations under the Registration Convention) in accordance with article VII of the Convention.” (UNGA Resolution 62/101 on enhancing the practice of States and international intergovernmental organizations in registering space objects, Recommendation 1)</p> <p>“The General Assembly ... recommends, with regard to harmonization of practices, that: (a) consideration should be given to achieving uniformity in the type of information to be provided to the Secretary-</p>	



Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>General on the registration of space objects, ... ; (b) consideration should be given to furnishing of additional appropriate information to the Secretary-General on ...: (i) geostationary orbit location, where appropriate; (ii) any change of status in operations (inter alia, when a space object is no longer functional); (iii) the approximate date of decay or re-entry, is States are capable of verifying that information; (iv) the date and physical conditions of moving a space object to a disposal orbit; (v) web links to official information on space objects. (c) States ..., when they have designated focal points for their appropriate registries, provide the OOSA of the Secretariat with the contact details of those focal points." (UNGA Resolution 59/115 on Application of the concept of the "launching State", Recommendation 2)</p> <p>"The General Assembly ... : <i>Agrees</i> that the voluntary guidelines for the mitigation of space debris reflect the existing practices as developed by a number of national and international organizations, and invites Member States to implement those guidelines through relevant national mechanisms. ... <i>The General Assembly ...: Agrees</i> that the voluntary guidelines for the mitigation of space debris reflect the existing practices as developed by a number of national and international organizations, and invites Member States to implement those guidelines through relevant national mechanisms" (UNGA Resolution 62/217 on Space Debris Mitigation Guidelines, item 26 and 27)</p> <p>"1. Member States shall endeavour to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services. 2. In using frequency bands for radio services, Members shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries. (The ITU Constitution, Art. 44)</p> <p>"Each Member State undertakes to require the operating agencies which it recognizes and the other operating agencies duly authorized for this purpose to observe the provisions of No. 197 above." (The ITU Constitution, Art. 45)</p> <p>" ..., the Member States recognize the necessity of taking all practicable steps to prevent the operation of electrical apparatus and installations of all kinds from causing harmful interference to the radio services or communications mentioned in No. 197 above." (The ITU Constitution, Art. 45)</p> <p>"Member States agree to take steps required to prevent the transmission or circulation of false or deceptive distress, urgency, safety or identification signals, and to collaborate in locating and identifying stations under their jurisdiction transmitting such</p>	

Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>signals." (The ITU Constitution, Art. 47)</p> <p>"The Subscribing States ... resolve to respect the following Principles: g) Recognition that Space Launch Vehicle programmes should not be used to conceal Ballistic Missile programmes; h) Recognition of the necessity of appropriate transparency measures on Ballistic Missile programmes and Space Launch Vehicle programmes in order to increase confidence and to promote non-proliferation of Ballistic Missiles and Ballistic Missile technology." (The Hague Code of Conduct, Art. 2)</p> <p>„The Subscribing States...resolve to implement the following General Measures: d) To exercise the necessary vigilance in the consideration of assistance to Space Launch Vehicle programmes in any other country so as to prevent contributing to delivery systems for weapons of mass destruction, considering that such programmes may be used to conceal Ballistic Missile programmes." (The Hague Code of Conduct, Art. 3)</p> <p>„The Subscribing States ... resolve to implement the following: a) Transparency measures as follows, with an appropriate and sufficient degree of detail to increase confidence and to promote non-proliferation of Ballistic Missiles capable of delivering weapons of mass destruction: (ii) with respect to expendable Space Launch Vehicle programmes, and consistent with commercial and economic confidentiality principles, to: make an annual declaration providing an outline of their Space Launch Vehicle policies and land (test-) launch sites; provide annual information on the number and generic class of Space Launch Vehicles launched during the preceding year, as declared in conformity with the pre-launch notification mechanism referred to hereunder, in tiret iii); consider, on a voluntary basis (including on the degree of access permitted), inviting international observers to their land (test-) launch sites; (iii) With respect to their Ballistic Missile and Space Launch Vehicle programmes to: exchange pre-launch notifications on their Ballistic Missile and Space Launch Vehicle launches and test flights. These notifications should include such information as the generic class of the Ballistic Missile or Space Launch Vehicle, the planned launch notification window, the launch area and the planned direction." (The Hague Code of Conduct, Art. 4)</p> <p>„The Subscribing States ... resolve to implement: b) as appropriate and on a voluntary basis, develop bilateral or regional transparency measures, in addition to those above." (The Hague Code of Conduct, Art. 4)</p> <p>„Subscribing States determine to: a) Hold regular meetings, annually or as otherwise agreed by Subscribing States; b) Take all decisions, both substantive and procedural, by a consensus of the Subscribing States present; c) Use these meetings to define, review and further develop the workings of the Code, including in such ways as: establishing procedures regarding the exchange of notifications and other information in the framework of the Code; establishing an appropriate mechanism for the voluntary resolution of questions arising from national</p>	



Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>declarations, and/or questions pertaining to Ballistic Missile and/or Space Launch Vehicle programmes; naming of a Subscribing State to serve as an immediate central contact for collecting and disseminating Confidence Building Measures submissions, receiving and announcing the subscription of additional States, and other tasks as agreed by Subscribing States;" (The Hague Code of Conduct, Art. 5)</p> <p>"Organisations are encouraged to use these Guidelines in identifying the standards that they will apply when establishing the mission requirements for planned spacecraft and orbital stages." (IADC Mitigation Guidelines, Art. 2)</p> <p>"Operators of existing spacecraft and orbital stages are encouraged to apply these guidelines to the greatest extent possible." (IADC Mitigation Guidelines, Art. 2)</p>	
Informational Measures	<p>"States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the UN of any phenomena they discover in outer space, ... , which could constitute a danger to the life or health of astronauts. " (OST, Art. 5)</p> <p>"..., States Parties to the Treaty conducting activities in outer space, ... , agree to inform the Secretary-General of the UN as well as the public and international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations, and results of (conduct of their activities in outer space)." (OST, Art. 11)</p> <p>"Any State launching a space object with nuclear power sources on board shall in a timely fashion inform States concerned in the event this space object is malfunctioning with a risk of re-entry of radioactive materials to the Earth." (UNGA Resolution 47/68 on the Use of Nuclear Power Sources in Outer Space, Principle 5)</p> <p>"The General Assembly ... recommends ... , that: The State from whose territory or facility a space object has been launched should, in the absence of prior agreement, contact States or international intergovernmental organizations that could qualify as "launching States" to jointly determine which State entity should register the space object." (UN GA Resolution 59/115 on Application of the concept of the "launching State", Recommendation 3)</p>	<p>"We, the undersigned, ... declare ... the responsibility to share information related to safe space operations and traffic management ...;" (The Stimson Center Code of Conduct)</p>
Consultative Measures	<p>"If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, ... , would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, ... , it shall undertake appropriate international consultations before proceeding with any such activity or experiment." (OST, Art. 9)</p> <p>"A State Party to the Treaty which has a reason to believe that an activity or experiment planned by another State party in outer space, ... , would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, ... ,</p>	<p>„When a dispute arises between States Parties concerning the application or the interpretation of the provisions of this Treaty, the parties concerned shall first consult together with a view to settling the dispute by negotiation and cooperation. When the parties concerned do not come to an agreement after consultation, the disputed situation that has arisen may be referred to the Executive organization of the Treaty along with provision of</p>

Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>may request consultation concerning the activity or experiment." (OST, Art. 9)</p> <p>"A State which intends to establish or authorize the establishment of an international direct television broadcasting satellite service shall without delay notify the proposed receiving State or States of such intention and shall promptly enter into consultation with any of those States which so requests." (UN GA Resolution 37/92 on Satellites for International Direct TV Broadcasting, Art. 13)</p> <p>"..., a State carrying out remote sensing of the Earth from space shall, upon request, enter into consultations with State whose territory is sensed in order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom." (UNGA Resolution 41/65 on Remote Sensing, Principle 13)</p> <p>"States providing information with principle 5 (malfunctioning of a space object with a risk of re-entry of radioactive materials to the Earth with nuclear power sources aboard) shall, as far as reasonably practicable, respond promptly to requests for further information or consultations sought by other States." "Any State launching a space object with nuclear power sources on board shall in a timely fashion inform States concerned in the event this space object is malfunctioning with a risk of re-entry of radioactive materials to the Earth." (UNGA Resolution 47/68 on the Use of Nuclear Power Sources in Outer Space, Principle 6)</p>	<p>the relevant argumentation. Each State Party shall undertake to cooperate in the settlement of the disputed situation that has arisen with the Executive organization of the Treaty. (PPWT, Art. 7)</p> <p>"We, the undersigned, ... declare the ... the responsibility to consult with other space-faring states regarding activities of concern in space ...; The responsibility to establish consultative procedures to address and resolve questions relating to compliance with this Code of Conduct, and to agree upon such additional measures as may be necessary to improve the viability and effectiveness of this Code of Conduct." (The Stimson Center Code of Conduct)</p>
Notification Measures	<p>"If a State Party becomes aware that another State Party plans to operate simultaneously in the same area of or in the same orbit around or trajectory to or around the Moon, it shall promptly inform the other State of the timing of and plans for its own operations." (The Moon Treaty, Art. 5)</p> <p>" ... the results of (a thorough and comprehensive) safety assessment, together with, to the extent feasible, an indication of the approximate intended time-frame of the launch, shall be made publically available prior to each launch," (UNGA Resolution 47/68 on the Use of Nuclear Power Sources in Outer Space, Principle 4)</p>	
Constraint Measures	<p>"Outer space, ... , is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." (OST, Art. 2)</p> <p>"States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner." (OST, Art IV)</p> <p>"The establishment of military bases, installations, and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial</p>	<p>"We, the undersigned, ... declare ... the responsibility to regulate stakeholders that operate within their territory or that use their space launch services in conformity with the objectives and purposes of this Code of Conduct; Each state has the responsibility to regulate the behaviour of its nationals in conformity with the objectives and purposes of this Code of Conduct, whenever those actions occur; The responsibility to develop and</p>

¹⁸⁶ Other Articles of the Liability Convention likewise represent "constraint measures" (see Convention on International Liability for Damage Caused by Space Objects, Adopted by the General Assembly in its resolution 2777 (XXVI) of November 1971).



Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCMBs	Proposed Space-Related TCMBs
	<p>bodies shall be forbidden.” (OST, Art IV)</p> <p>“States Parties to the Treaty shall bear international responsibility for national activities in outer space, ... , whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, ... , shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, ... , by an international organization, responsibility for compliance with this treaty shall be borne by the international organization and by State Parties to the Treaty participating in such organization.” (OST, Art. VI)</p> <p>“Each State Party to the Treaty that launches or procures launching of an object in outer space, ... , and each State Party from whose territory or facility an object is launched, in internationally liable for damage to another State Party to the Treaty,” (OST, Art. VII)</p> <p>“States Parties to the Treaty shall pursue studies of outer space, ... , and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of Earth,” (OST, Art. 9)</p> <p>“Expenses incurred in fulfilling obligations to recover and return a space object or its component parts ... shall be borne by the launching authority.” (The Astronauts Rescue Agreement, Art. 5)</p> <p>“A launching State shall be absolutely liable to pay compensation for damage caused by its object on the surface of the earth or to aircraft in flight.” (The Liability Convention, Art. 2)¹⁸⁶</p> <p>“When a space object is launched into Earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary General of the UN of the establishment of such a registry.” (The Registration Convention, Art. 2)</p> <p>“The Moon and its natural resources are the common heritage of mankind,” (The Moon Treaty, Art. 11)</p> <p>“In order to minimize the quantity of radioactive material in space and the risks involved, the use of nuclear power sources in outer space shall be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way.” (UNGA Resolution 47/68 on the Use of Nuclear Power Sources in Outer Space, Principle 3)</p> <p>“A launching State ..., at the time of launch shall, prior to the launch, ... ensure that a thorough and comprehensive safety assessment is conducted.” (UNGA Resolution 47/68 on the Use of Nuclear Power Sources in Outer Space, Principle 4)</p> <p>“All stations, ... , must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of</p>	<p>abide by rules of safe space operation and traffic management; The responsibility to mitigate and minimize space debris in accordance with the best practices established by the international community ...; The responsibility to refrain from harmful interference against space objects. ...” (The Stimson Center Code of Conduct)</p> <p>“States Parties undertake not to place in orbit around the Earth any objects carrying any kind of weapons, not to install such weapons on celestial bodies, and not to station such weapons in outer space in any other manner; not to resort to the threat or use of force against outer space objects; not to assist or encourage other states, groups of states or international organizations to participate in activities prohibited by the Treaty.” (PPWT, Art. 2)</p> <p>“State [Parties]/[Signatories] to the [Treaty]/[Code of Conduct] [shall]/[should] not test or use a weapon against any satellite so as to damage or destroy it. ... Note that such an undertaking would again need to be done in conjunction with a prohibition on the placement of weapons in outer space, lest we inadvertently provide a sanctuary for space-based weapons. Furthermore, a prohibition on the test or use of any satellite itself as a weapon capable of inflicting damage or destruction on any other object, would address the for space-based weapons. Furthermore, a prohibition on the test or use of any satellite itself as a weapon capable of inflicting damage or destruction on any other object, would address the residual threat of a benign dual-use satellite serving as a weapon. Taken together, these three rules would prohibit armed conflict in outer space based on the application of physical force.” (Canada’s Working Paper, CD 1865)</p> <p>The above security proposal would also obtain a concomitant safety guarantee preventing the production of space debris or derelicts that could result in the production of space debris dur-</p>

Transparency and Confidence-Building Measures (TCBM)	Existing Space-Related TCBMs	Proposed Space-Related TCBMs
	<p>other Member States or of recognizes operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio regulations." (The ITU Constitution, Article 45)</p> <p>"Radio stations shall be obliged to accept, with absolute priority, distress calls and messages regardless of their origin, to reply in the same manner to such messages, and immediately to take such action in regard thereto as may be required." (The ITU Constitution, Art. 46)</p> <p>"During an organisation's planning for and operation of a spacecraft and/or orbital stage, it should take systematic actions to reduce adverse effects on the orbital environment by introducing space debris mitigation measures into the spacecraft or orbital stage's lifecycle, from the mission requirement analysis and definition phases. In order to manage the implementation of space debris mitigation measures, it is recommended that a feasible Space Debris Mitigation Plan be established and documented for each program and project. The Mitigation Plan should include the following items: (1) A management plan addressing space debris mitigation activities (2) A plan for the assessment and mitigation of risks related to space debris, including applicable standards; (3) The measures minimising the hazard related to malfunctions that have a potential for generating space debris; (4) A plan for disposal of the spacecraft and/or orbital stages at end of mission; (5) Justification of choice and selection when several possibilities exist; (6) Compliance matrix addressing the recommendations of these Guidelines." (The IADC Space Debris Mitigation Guidelines, 4. General Guidance)</p>	<p>ing subsequent collisions. This proposed security guarantee therefore helps ensure the sustainability of outer space for the future. The risk to the international community of settling for a weaker proposal is that we will endorse a proliferation path for the test of specially designed or modified devices, to serve as anti-satellite weapons capable of producing indiscriminate effects through the production of space debris, or we will close an avenue for needed self-defence measures against the future prospect of space-based weapons. (Canada's Working Paper, CD 1865)</p>
Access Measures	<p>"Outer space, ... , shall be free for exploration and use by all States, ... , and there shall be free access to all areas of celestial bodies." (OST, Art. 1)</p> <p>" ... the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States." (OST, Art. 10)</p> <p>"All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to the representative of other States Parties to the Treaty on a basis of reciprocity." (OST, Art. 12)</p> <p>"There shall be full and open access to the information in ... Register (maintained by the Secretary-General of the UN)." (The Registration Convention, Art. 3)</p>	

Table 3: Existing and Proposed Space-Related TCBMs

Naturally, countries will continue to be highly attentive to issues relevant to their national security. As space offers an ideal environment for engaging in asymmetric warfare,

the pursuit of developing (and testing) ASAT's and other counterspace systems will likely remain attractive. Samuel Black argues that a provision banning harmful interference



with satellites would provide a partial way out of this security conundrum. Specifically, should this provision be embedded in international behaviour, the victim of interference could more easily gain international support for reprisal. He likewise argues that it is most likely that nations developing and operating space assets will also develop means to respond to possible interference. He concludes that the strategies to hedge against the possibility of violation of the principle of non-interference would serve as a deterrent as countries become more hesitant to carry out such acts.¹⁸⁷

Black also asserts that the principle of non-interference with space objects will be an indispensable component of any code of conduct.¹⁸⁸ He observes that international treaties, including the provision of non-interference with the NTM, do not cover satellites uninvolved with treaty verification (and therefore not the NTM). Accordingly, the provision for non-interference with space objects is necessary to create an incentive to the peaceful resolution of potential disputes.¹⁸⁹

There also continues to exist “grey areas” of verification, most notably accidental versus purposeful interference. Moreover, as argued by Lt. Col. Brandon Hart, it is not clear from the OST’s article 9, for example, what level of certainty concerning interference is required before requesting international consultations.¹⁹⁰ As the question concerning when to request consultations does not have a single answer, it most probably calls for a case-by-case approach, but utilising the benefits of established TCBMs. For example, the February 2009 debris-causing collision between Russian satellite Kosmos and the U.S. Iridium triggered application of TCBMs. In this case the U.S. and Russia were in communication promptly following the collision. In addition, four months after the collision, experts from both countries met in Vienna to discuss the incident and identify opportunities for bilateral space TCBMs.

3.4 Advantages and Limitations of Space-Related TCBMs

Space-related TCBMs have a history of bringing benefits as well as associated “baggage”. At its forty-fifth session in December 1990, the General Assembly adopted two resolutions concerning outer space, resolution 45/55 A entitled “Prevention of an arms race in outer space”, and resolution 45/55 B, entitled “Confidence-building measures in outer space”. Based on the second resolution, a research project entitled “Study on the Application of Confidence-Building Measures in Outer Space” was carried out by governmental experts between 1991 and 1993.¹⁹¹ TCBMs for space were likewise introduced in a 2006 Russian and Chinese working paper in the CD which led to the adoption of UNGA resolution 62/43 of December 2007 on “Transparency and Confidence-Building Measures in Outer Space Activities”.¹⁹² Prior UNGA resolutions on TCBM included 60/66 and 61/75 and the most recent one is UNGA resolution 64/49.

When promoting space TCBMs related to bottom-up approaches to managing space activities, it should be acknowledged that both Russia and China, who proposed the CD-related TCBMs, are proponents of a legally-binding treaty on banning space weapons. These realities make it more difficult to persuade some space actors of the benefits of TCBMs for non-binding agreements. The arguments put forth include: 1) engagement in TCBMs eventually leads to being shackled by a legally-binding treaty unfavourable to a country’s national security priorities; and 2) TCBMs simply do not work as advertised. That said, the reality is that the bottom-up approach is currently viewed as the more promising. Accordingly, it is useful to weigh the benefits and limitations of TCBMs in the relevant circumstances prior to making a judgment concerning their value.

Benefits of TCBMs include:

¹⁸⁷ Black, Samuel. “No Harmful Interference with Space Objects: The Key to Confidence-Building.” *Stimson Center Report* 69 (2008): 9–10.

¹⁸⁸ *Ibid.*: 8.

¹⁸⁹ *Ibid.*: 11.

¹⁹⁰ Hart, Brandon L. “Transparency & Confidence Building Measures: Treaties, National Legislation, National Policies, and Proposals for Non-Binding Measures.” Eds. Jana Robinson et al. *Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security*. ESPI Report 27. Vienna: European Space Policy Institute (2010).

¹⁹¹ “Study on the Application of Confidence-building Measures in Outer Space.” United Nations Centre for Disarmament Affairs. 21 July 2010. <www.un.org/disarmament/HomePage/ODAPublications/DisarmamentStudySeries/PDF/SS-27.pdf>.

¹⁹² Conference on Disarmament. “Working Paper: Transparency and Confidence-Building Measures in Outer Space Activities and the Prevention of Placement of Weapons in Outer Space.” Doc. CD/1776 of 22 May 2006. 26 July 2007. <<http://www.reachingcriticalwill.org/political/cd/papers06/22MayChinaRussia1.pdf>>.

- Advance cooperation in space is a necessity by allowing a certain level of flexibility
- TCBMs seek to facilitate the establishment of predictable processes
- TCBMs provide a policy framework to promote specific behavioural objectives
- TCBMs can reinforce a space culture of cooperation and peer review
- TCBMs help balance national and international interests
- The process of implementing TCBMs is often slow, and includes setbacks, but it can assist in generating political will and understanding
- Those countries that comply with TCBMs serve as more established supporters of international nonproliferation and other norms.
- TCBMs allow for informal exchanges between countries as well as non-governmental entities

Among the limitations are arguments that TCBMs have only limited influence that will not prevent countries from hedging or space-related abuses¹⁹³; they tend not to enforce monitoring and verification provisions and require participants that are willing to cooperate fulsomely. Brandon Hart asserts that when configuring space-specific TCBMs, nations should avoid a number of “traps”. They include: avoiding redundancy by mere reiteration of binding obligations of existing space treaties or guidelines (e.g. Debris Mitigation Guidelines); putting forth TCBMs that are in conflict with binding rights from existing space treaties (e.g. zones of sovereignty around satellites that are contrary to the free use of space as described in article 1 of the OST and against prohibition of claims of sovereignty in outer space as provided for in article II of the OST); and imposing the high costs associated with a new mechanism while existing treaty obligations are neglected.¹⁹⁴

¹⁹³ O'Hanlon, Michael E. “Arms Control In Space. Neither Star Wars Nor Sanctuary: Constraining the Military Uses of Space.” The Brookings Institution: Washington DC, 2004. 115.

¹⁹⁴ Hart, Brandon L. “Transparency & Confidence Building Measures: Treaties, National Legislation, National Policies, and Proposals for Non-Binding Measures.” Eds. Jana Robinson et al. Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security. ESPI Report 27. Vienna: European Space Policy Institute (2010).



4. TCBMs and EU Draft Code of Conduct

The display of non-transparency by China concerning its ASAT test of January 2007 caused some alarm, including in Europe. As a response, a document entitled “Food For Thought on a Possible Comprehensive Code of Conduct for Space Objects” was introduced by Italy in the CD in March 2007. The document highlighted a number of gaps in existing TCBMs and that new confidence-building measures would be necessary to strengthen adherence to, and implementation of, binding and non-binding space security-related obligations. The EU endorsed this initiative under Title V of the EU Treaty Concerning the Common Foreign and Security Policy (CFSP) which was presented to the General Assembly as the European reaction to UNGA Resolution 61/75 on TCBMs.¹⁹⁵ Also in 2007, Germany organised a workshop entitled “Security and Arms Control in Space and the Role of the EU” in Berlin as part of its effort to insert space arms control on the EU agenda. In September 2007, the EU expressed its desire to have specific TCBMs (as opposed to more general rules of the road) considered at the UN COPUOS.

In the autumn of 2007, the Portuguese EU Presidency prepared a first version of an EU Code of Conduct, later updated by the Slovenian Presidency into “Best Practice Guidelines for/Code of Conduct on Outer Space Activities”. By summer 2008, the first informal consultations were undertaken with key space-faring nations, including the U.S., China and Russia. The French Presidency that took over in July 2008 continued to promote the Code which resulted in the official release of the Draft Code of Conduct by the EU Council in December 2008.¹⁹⁶ The EU then began to introduce the Code to other nations, as well as international bodies. The Czech Presidency, for example, reviewed the Code at the February 2009 plenary session of the CD. In addition to the U.S., China, and Russia, the EU has since initiated bilateral negotiations

with Brazil, Canada, India, Indonesia, Israel, South Korea, South Africa and Ukraine.¹⁹⁷

The EU Draft Code of Conduct is one of the central proposals for a voluntary international agreement to enhance space security. It is, in part, designed to serve as an alternative to treaty proposals for prevention of an arms race in outer space or bans on space weapons (e.g. PPWT). Moreover, it is an effort on the part of the EU to play a normative role in space security through the “principled” identity it seeks to achieve.¹⁹⁸ The EU Council Conclusions state that the Code of Conduct includes “transparency and confidence-building measures as a basis for consultations with key third countries” involved, or interested in, outer space activities.¹⁹⁹ The EU Draft Code of Conduct was deliberately structured outside of traditional multilateral institutions like the UN and the CD and aims at strengthening the existing international framework for the management of space activities.

The five space treaties, and other arrangements, have already provided a solid foundation for guidelines and norms. For example, Article 9 of the OST could be viewed as a harbinger for the TCBMs.²⁰⁰ Given the current dynamics of this space debate, however (as evidenced by, for example, the Inter-Agency Space Debris Coordinating Committee and the Space Data Association), there is a need for broader bottom-up support for space security. This is also due to the slow progress of the traditional international arms control negotiating forum, the CD. Indeed, the CD and the absence of military-relevant discussions at the UN COPUOS tend to constrain a more comprehensive dialogue on space security issues, including innovative space-related TCBMs. Moreover, there needs to be a focus on operational-level engagement, which tra-

¹⁹⁵ Hobe, Stephan, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl (eds.). *Cologne Commentary on Space Law; Volume 1; Outer Space Treaty.* Cologne: Carl Heymanns Verlag, 2009. 180.

¹⁹⁶ Rathgeber, Wolfgang, Nina-Louisa Remuß, and Kai-Uwe Schrogl. “Space Security and the European Code of Conduct for Outer Space activities.” *Disarmament Forum 4* (2009). 35–36.

¹⁹⁷ *Ibid.*: 38.

¹⁹⁸ *Ibid.*: 40.

¹⁹⁹ „Council Conclusions and Draft Code of Conduct for Outer Space Activities.” 17 Dec. 2008. Council of the European Union. 22 July 2010.

<http://register.consilium.europa.eu/pdf/en/08/st17/st17175_en08.pdf>: 2.

²⁰⁰ Hobe, Stephan, Bernhard Schmidt-Tedd, and Kai-Uwe Schrogl (eds.). *Cologne Commentary on Space Law; Volume 1; Outer Space Treaty.* Cologne: Carl Heymanns Verlag, 2009. 180.

ditionally favours informal arrangements and a bottom-up approach.

4.1 Establishing Consensus on Behaviour to Enhance Space Security

The Preamble of the Draft EU Code of Conduct references, among other items, that “a comprehensive code, including TCBMs could contribute to promoting common and precise

understandings”.²⁰¹ In this connection, adopting appropriate TCBMs can help carry out the Code’s purpose, as well as determine how best to utilise SSA (see Figure 1). Although not altogether precise and leaving some ambiguities, TCBMs can help clarify what subscribing states have signed up to. For example, as stated in the Code’s purpose and scope: “This code, in codifying new best practices, contributes to transparency and confidence-building measures and is complementary to the existing framework regulating outer space activities”.²⁰² In this connection, it is useful to review, in Table 4 below, what are the “best practices” TCBMs offered and which TCBMs from the existing framework applied in the EU Draft Code need to be significantly strengthened.

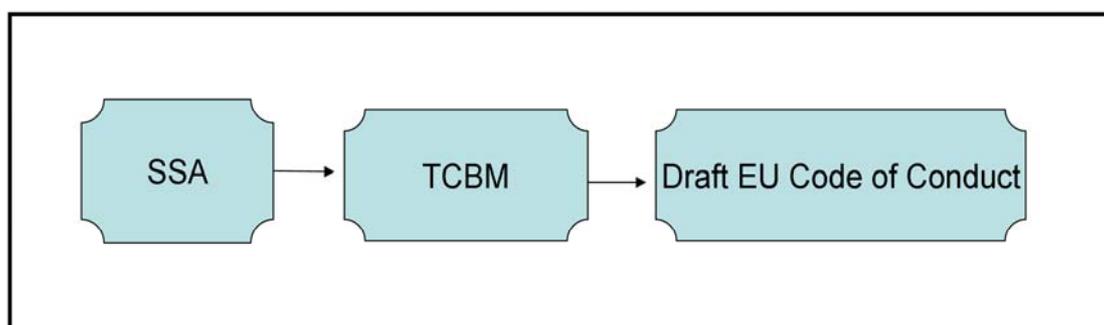


Figure 1: TCBMs as Link between SSA and Code of Conduct

²⁰¹ “Council Conclusions and Draft Code of Conduct for Outer Space Activities.” 17 Dec. 2008. Council of the European Union. 22 July 2010. <http://register.consilium.europa.eu/pdf/en/08/st17/st17175_en08.pdf>: 4.

²⁰² *Ibid.*: 5.



The EU Draft Code of Conduct ²⁰³	Existing International Space Law/Soft Law Covering Provisions of EU Draft Code of Conduct	Terrestrial TCBMs Covering Provisions of EU Draft Code of Conduct Not Treated By Existing Space Law/Soft Law	Proposed TCBMs to Fill Remaining Gaps
1.1. The purpose of the present code is to enhance the safety, security and predictability of outer space activities for all.	*OST (Preamble)		*IAASS (“Memorandum of Understanding Concerning International Cooperation in the Field of Space Safety Standards: Study Draft”)
1.2. The present Code is applicable to all outer space activities conducted by a Subscribing State or jointly with other State(s) or by non-governmental entities under the jurisdiction of a Subscribing State, including those activities within the framework of international intergovernmental organisations.	*OST (Art. 6)		
1.3. This Code, in codifying new best practices, contributes to transparency and confidence-building measures and is complementary to the existing framework regulating outer space activities.			*COPUOS “Long-Term Sustainability of Outer Space Activities” Initiative
1.4. Adherence to this Code and to the measures contained in it is voluntary and open to all States.		*ICOC (2d)	
<p>2. General principles</p> <p>The Subscribing States resolve to abide by the following principles:</p> <ul style="list-style-type: none"> • the freedom of access to, exploration and use of outer space and exploitation of space objects for peaceful purposes without interference, fully respecting the security, safety and integrity of space objects in orbit; • the inherent right of individual or collective self-defence in accordance with the United Nations Charter; • the responsibility of States to take all the appropriate measures and cooperate in good faith to prevent harmful interference in outer space activities; • the responsibility of States, in the conduct of scientific, commercial and military activities, to promote the peaceful exploration and use of outer space and take all the adequate measures to prevent outer space from becoming an area of conflict; 	*OST (Art. 1, Art. 3)		<p>*“Harmful interference”: The Stimson Center Code of Conduct</p> <p>*“Prevent outer space from becoming an area of conflict”: Countries could re-channel their attention from debates on prevention of an arms race in outer space (where little progress is expected in the near term) to individual declarations, gestures, and actions that make clear their peaceful intent in space.</p>
3.1. The Subscribing States reaffirm their commitment to: the existing legal framework relating to outer space activities; making progress towards adherence to,	*UNGA Resolution 63/90		*It may prove useful to leave out explicit references to non-space law agreements as they may hold back some nations from subscribing to the EU

²⁰³ The EU Draft Code of Conduct for Outer Space Activities can be accessed at: <<http://register.consilium.europa.eu/pdf/en/08/st17/st17175.en08.pdf>>.

<p>and implementation of: (a) the existing framework regulating outer space activities, inter alia: the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967); the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (1968); the Convention on International Liability for Damage Caused by Space Objects (1972); the Convention on Registration of Objects Launched into Outer Space (1975); the Constitution and Convention of the International Telecommunications Union and its Radio Regulations (2002); the Treaty banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (1963) and the Comprehensive Nuclear Test Ban Treaty (1996); the International Code of Conduct against Ballistic Missile Proliferation (2002). (b) declarations and Principles, inter alia: the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space as stated in UNGA Resolution 1962 (XVIII); the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as stated in UNGA Resolution 47/68; the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries as stated in UNGA Resolution 51/122; The Recommendations on the Practice of States and International Organisations in Registering Space Objects as stated in UNGA Resolution 62/101; the Space Debris Mitigation Guidelines of the United Nations Committee for the Peaceful Uses of Outer Space as stated in UNGA Resolution 62/217.</p>			Code
<p>3.2. The Subscribing States also reiterate their support to encourage coordinated efforts in order to promote universal adherence to the above mentioned instruments.</p>	*OST (Art. 1)		*Stimson Center Code of Conduct
<p>4.1. The Subscribing States will establish and implement national policies and procedures to minimise the possibility of accidents in space, collisions between space objects or any form of harmful interference with other States' right to the peaceful exploration and use of outer space.</p>	*UNGA Resolution 62/217 *UNGA Resolution 59/115		



<p>4.2. The Subscribing States will, in conducting outer space activities: refrain from any intentional action which will or might bring about, directly or indirectly, the damage or destruction of outer space objects unless such action is conducted to reduce the creation of outer space debris and/or justified by imperative safety considerations; take appropriate steps to minimise the risk of collision; abide by and implement all International Telecommunications Union recommendations and regulations on allocation of radio spectra and orbital assignments.</p>	<p>*IADC Space Debris Mitigation Guidelines *ITU Constitution, RR</p>		<p>**“imperative safety considerations” need to be defined: IAASS Manifesto</p>
<p>4.3. When executing manoeuvres of space objects in outer space, for example to supply space stations, repair space objects, mitigate debris, or reposition space objects, the Subscribing States agree to take all reasonable measures to minimise the risks of collision.</p>		<p>*Incidents at Sea Agreement</p>	
<p>4.4. The Subscribing States resolve to promote the development of guidelines for space operations within the appropriate fora for the purpose of protecting the safety of space operations and long term sustainability of outer space activities.</p>			<p>*COPUOS “Long-Term Sustainability of Outer Space Activities” Initiative</p>
<p>5. Measures on space debris control and mitigation In order to limit the creation of space debris and reduce its impact in outer space, the Subscribing States will: refrain from intentional destruction of any on-orbit space object or other harmful activities which may generate long-lived space debris; adopt, in accordance with their national legislative processes, the appropriate policies and procedures in order to implement the Space Debris Mitigation Guidelines of the United Nations Committee for the Peaceful Uses of Outer Space as endorsed by UNGA Resolution 62/217.</p>	<p>*IADC Space Debris Mitigation Guidelines *UNGA Resolution 62/217</p>		
<p>6.1. The Subscribing States commit to notify, in a timely manner, to the greatest extent feasible and practicable, all potentially affected Subscribing States on the outer space activities conducted which are relevant for the purposes of this Code, inter alia:</p> <ul style="list-style-type: none"> • the scheduled manoeuvres which may result in dangerous proximity to space objects; • orbital changes and re-entries, as well as other relevant orbital parameters; • collisions or accidents which have taken place; • the malfunctioning of orbiting 		<p>*ICOC (4a iii; 4b)</p>	

space objects with significant risk of re-entry into the atmosphere or of orbital collision.			
6.2. The Subscribing States reaffirm their commitment to the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as stated in UNGA Resolution 47/68.	*UNGA Resolution 47/68		
7. Registration of space objects The Subscribing States undertake to register space objects in accordance with the Convention on Registration of Objects launched in Outer Space and to provide the United Nations Secretary-General with the relevant data as set forth in this Convention and in the Recommendations on the Practice of States and International Organisations in Registering Space Objects as stated in UNGA Resolution 62/101.	*Registration Convention *UNGA Resolution 62/101		
8.1. The Subscribing States resolve to share, on an annual basis, and, where available, information on: national space policies and strategies, including basic objectives for security and defence related activities; national space policies and procedures to prevent and minimise the possibility of accidents, collisions or other forms of harmful interference; national space policies and procedures to minimise the creation of space debris; efforts taken in order to promote universal adherence to legal and political regulatory instruments concerning outer space activities.			*Mechanism for sharing information is required.
8.2. The Subscribing States may also consider providing timely information on space environmental conditions and forecasts to other Subscribing States or private entities through their national space situational awareness capabilities.	*The Registration Convention *The Stimson Center Code of Conduct		
9. Consultation mechanism 9.1. Without prejudice to existing consultation mechanisms provided for in Article IX of the Outer Space Treaty of 1967 and in Article 56 of the ITU Constitution, the Subscribing States have decided on the creation of the following consultation mechanism: A Subscribing State with reason to believe that certain outer space activities conducted by one or more Subscribing State(s) are, or may be, contrary to the purposes of the Code may request consultations with a view to achieving acceptable solutions regarding measures to be adopted in order to prevent or minimise the inherent risks. The Subscribing States involved in	*Outer Space Treaty (Art 9) *ITU Constitution *PPWT (Art. 7)		*Need to clarify a list of actions that are contrary to the Code's purpose. **"Equitable balance of interest" may be difficult to define. The focus could be on the violator(s) and the level of willingness to remedy the risk created



<p>a consultation process will decide on a timeframe consistent with the timescale of the identified risk triggering the consultations. Any other Subscribing State which may be affected by the risk and requests to take part in the consultations will be entitled to take part. The Subscribing States participating in the consultations shall seek solutions based on an equitable balance of interests.</p>			
<p>9.2. In addition, the Subscribing States may propose to create a mechanism to investigate proven incidents affecting space objects. The mechanism, to be agreed upon at a later stage, could be based on national information and/or national means of investigation provided on a voluntary basis by the Subscribing States and on a roster of internationally recognised experts to undertake an investigation.</p>			<p>*Mechanism should have clear delineation, be applied on a case-specific basis and include the affected countries, other countries by invitation.</p>
<p>10.1. The Subscribing States decide to hold meetings biennially or as otherwise agreed by Subscribing States, to define, review and further develop this Code and ensure its effective implementation. The agenda for such biennial meetings could include: (i) review of the implementation of the Code, (ii) evolution of the Code and (iii) additional measures which appear necessary.</p>			<p>*Need to specify how the Code is to be implemented, for example, through traditional fora: CD, COPUOS, or the ICOC-like structure.</p>
<p>10.2. The decisions will be taken by consensus of the Subscribing States present at the meeting.</p>	---		
<p>11. Central point of contact A central point of contact shall be nominated among Subscribing States to:</p> <ul style="list-style-type: none"> • receive and announce the subscription of additional States; • maintain the electronic information-sharing system; • serve as secretariat at the biennial meetings of Subscribing States; • carry out other tasks as agreed by Subscribing States. 		<p>*ICOC (Austria serves as the Immediate Central Contact)</p>	<p>*Specification of proposed objectives {?} for the central point of contact will be needed (e.g. comparison, with the ICOC).</p>
<p>12. Outer Space Activities Database The Subscribing States will create an electronic database to:</p> <ul style="list-style-type: none"> • collect and disseminate notifications and information submitted in accordance with the provisions of this Code; • channel requests for consultations. 	<p>* The Registration Convention</p>		<p>*Need to specify the management of registering "space objects" proposed in the Code. With respect to a new entity, security of the data would need to be arranged.</p>

Table 4: The EU Draft Code of Conduct and Existing and Proposed Space-Related TCBMs

Naturally, criticisms of the EU Draft Code of Conduct have surfaced. For example, Can-

ada's working paper "On the Merits of Certain Draft Transparency and Confidence-Building

Measures and Treaty Proposals For Space Security” focused its criticism on Article 4.2. of the EU Draft Code. It argued that “a national security prerogative is not an expressly authorized reason for the production of space debris” and that “it allows for a proliferation path for anti-satellite weapons”. As described above, the Canadian intervention concentrated mainly on a space weapons ban, while the EU Code seeks to address broader issues of strengthening existing UN treaties and other arrangements as well as calling for adherence to best practices in space.

Other concerns expressed with regard to the shortcomings of the EU Draft Code included pointing out that the EU Code does not address temporary interference with space objects or long-lived space debris, and that it fails to identify preferred negotiation fora, including potential overlap between the CD and COPUOS activities.²⁰⁴ The Code’s emphasis on behavioural recommendations can likewise be viewed by some as a limitation. Accordingly, the EU Code needs further refinement, including a consensus on whether the Code will remain outside of traditional venues like the CD and COPUOS.

To advance realisation of the Draft EU Code of Conduct, the following diplomatic tools could be used: 1) gauge the level of support on the part of other states for the proposed TCBMs; 2) generate the political will to pursue these TCBMs; and 3) fill in existing gaps to strengthen the TCBMs.

With regard to the first step, a favourable environment for adoption of TCBMs presently exists. The second step also appears within reach as discussions of a code of conduct do not seem bogged down as in the case of terrestrial arms control issues. Concerning the third step, the most urgent gaps have been identified and now require remedial measures. For the U.S. it may get down to a willingness to provide some of its unique capabilities in exchange for greater space stability. On the part of Europe, there exists greater recognition of the imperatives associated with space security. Space-specific TCBMs, therefore, require a willingness on the part of governments to provide support for expert gatherings to flesh out the details of SSA sharing, debris mitigation, collision avoidance, space weather information, radiofrequency interference, and counterspace threats. Europe’s own SSA capability, for example, would advance significantly the protection of its space-based infrastructure,

²⁰⁴ Rathgeber, Wolfgang, Nina-Louisa Remuß, and Kai-Uwe Schrogl. “Space Security and the European Code of Conduct for Outer Space activities.” Disarmament Forum 4 (2009): 37.

but can only achieve full potential if interoperable with American networks.

It is also critical to reinforce the EU Draft Code of Conduct by strengthening its enforcement provisions. This could be accomplished in the following ways:

- Make the Code attractive for subscription by focusing on the safer space operations, especially with the major space-faring nations;
- Underscore that it reinforces the provisions of the Outer Space Treaty as the traditional centrepiece of the international regime governing space activities
- Emphasise that use of space for peaceful purposes, consistent with the EU Code of Conduct, does not have to come at the expense of individual national security goals;
- Highlight that the EU Code promotes, rather than bans, behaviour, and the use of space remains open to all nations for mutual benefit;
- Point to the provision of common terms of reference
- Cite the establishment of an implementing body for consultative mechanisms

As referenced above, neither a Treaty proposal (e.g. the Canadian working paper or the PPWT), or an outright ban (along the lines of the terrestrial Ottawa Convention), are currently viable options. It is, therefore, the right time to invest political capital in the Code of Conduct. As Samuel Black observed, “unlike a code of conduct, no country has endorsed a partial ban on space weapons and warfare”.²⁰⁵

4.2 EU Code and Future Co-operative Space TCBM Architecture

It is clear that outer space activities are no longer a matter of solely U.S.-Russian bilateral relations. Accordingly, a broader framework of multilateral engagement involving the diplomatic, scientific, commercial, and military communities is required. As the U.S. has been focusing on bilateral TCBMs with Russia and China, it may be useful for Europe to establish itself as the fair and credible mediator of space TCBMs. When finalising the EU Code of Conduct, it will also be desirable

²⁰⁵ Black, Samuel. “Next Steps on a Code of Conduct for Responsible Space-Faring Nations.” ESPI Perspectives 32 (2010): 3.



to keep in mind the UN COPUOS's STSC effort which addresses the issue of "long-term sustainability of outer space activities" via "best practices guidelines".

At the same time, Europe should try to advance UN efforts through providing a platform to negotiate aspects of space security on a coalition basis, via exchanges and consultations with Code participants. Such exchanges would help reinforce essential norms, including denying numerous benefits to those that violate these norms. The debate could also include future governance of SSA, a fundamental building block for virtually any space norms. Among other items, a discussion of the definition, scope and implications of "interference", (which is referenced in the EU Code) could be mapped. As non-interference provision is also included in the OST (as well as a number of terrestrial arms control treaties) the Code could strengthen existing obligations.

Europe also needs to give greater attention to the challenges faced by commercial operators. The most visible sector is the telecommunication industry. Today, satellite operators use different software for flight operations and as a consequence characterise the orbital position of their satellites in a non-harmonious way. Operators likewise have to reformat information to comply with other owners' and operators' software systems for computing close approaches. Moreover, there is no established obligation (beyond that set by a national licensing authority) for satellite operators to participate in close-approach

monitoring and many of them choose not to participate, primarily due to a lack of resources or capabilities.²⁰⁶ Private efforts by these entities, some of which were described in the previous section, should be bolstered by a new legal framework to govern these activities.

Space security is not just an expression, but is rapidly becoming its own professional field. The institutionalisation of space security in Europe will need to be compatible with the EU's overall external relations in accordance with the Lisbon Treaty. Accordingly, space governance issues will require the attention of the President of the European Council and especially the High Representative for Foreign Affairs and Security Policy. The Lisbon Treaty entrusts the European Commission with the elaboration and the implementation of a European Space Policy which includes space security measures. At the same time, implementation of the EU Code will have, besides political considerations, technological, industrial, financial, scientific, and operational implications that will be managed by various space actors, including ESA and national space agencies. Accordingly, the connections between the EU Code and the newly recognised European Space Policy need to be better defined by the EU as the implementing body. Presumably, this would include resolving the ability of inter-governmental organisations, even subject to certain conditions, to participate in the EU Code of Conduct, to further substantiate the effort associated with this European space diplomatic initiative.

²⁰⁶ DalBello, Richard. "Commercial Efforts to Manage Space Environment." Disarmament Forum 4 (2009). 29.

5. Conclusion

Space TCBMs are here to stay and will only multiply from this point forward. Like their terrestrial counterparts, they are born of necessity and a shared interest in keeping space viable and secure. The number of space-faring nations, and those that aspire to this status, create complexities, as well as opportunities, for the shared use of space and the forging of multinational consortia (in both the public and private sectors) that often accompany expensive, technologically challenging undertakings.

The risks to space are likewise multiplying, with counterspace activities now widely regarded as a crucial element of asymmetric warfare. A number of more traditional space risks are likewise discussed in the study. The formulation that space is congested, contested, competitive, and complex is valid and will require Europe to play an essential role in adjudicating the “rules of the road” for space operations and activities. Fortunately, the EU has already put down a creative marker with its Draft Code of Conduct. The EU represents a natural bridge between space competitors and possesses the track record and credibility to serve as the principal “middle diplomat” of the global space community.

To maintain this leadership role, however, will necessitate the formulation of achievable and meaningful TCBMs to reinforce agreements and shape space behavioural norms. It will also take an activist approach in multilateral and other fora concerning the definition

of 21st century space security and the kinds of strengthened agreements needed for its component parts. Space situational awareness, orbital debris, radio-frequency interference, collision avoidance and new counterspace capabilities, to name a few, are all presenting policy-makers globally with unprecedented challenges that will not wait. Accordingly, the tempo of space security dialogues will need to be intensified. Verification, compliance and enforcement will carry the greatest political and policy risks but also the largest upside potential in keeping space safe and secure.

Fortunately, the European space community is up to this daunting task, largely through a quilt of mutually-reinforcing accords and voluntary understandings that serve to bolster overall space security. Although it is troubling to have to focus increasingly on the advent of space actors engaging in the deliberate disruption of space assets and/or missions, a passive posture is now more perilous. Irresponsible actors need to be put on notice in the near-term (via multilateral and other discussions) that offensive behaviour will be met with a truly global response. Demonstrating resolve is a necessary component of effective, preemptive space diplomacy. Europe’s ongoing effort to reach out to space-faring nations and aspirant states on the issues treated in this study will do much to ensure that potential “incidents” and miscalculations are headed off by a new space calculus worldwide.



6. Recommendations

General Measures

- *Raise Overall Awareness of Space Security Concerns.* This can be accomplished, in part, through organising intra- and inter-governmental expert groups that would conduct research, and propose viable solutions and/or policy options for decision-makers with regard to space debris, SSA/collision risk, interference, counterspace activities and other challenges. With a longer time horizon in mind, government-led education campaigns to recruit relevant experts on space security as well as provide funding for academic and non-governmental programmes to train future specialists would help build an adequately broad cadre of space security professionals. This expertise will be increasingly required in the period ahead. Ideally, space-faring nations would also seek to launch a global TCBM education campaign via different means (e.g. competitions, scholarships, media reports, research papers, etc.) to alert the larger community of relevant politicians to the urgency of this space portfolio.
- *Generate Greater Political Will to Cooperate.* Periodic “risk assessment” reports could be prepared that highlight the estimated impact of losing critical space infrastructure along the lines of the Marshall Institute and Space Enterprise Council’s *Day Without Space* series. Such reports could be presented to relevant governmental entities. A non-classified version of the reports could be shared with the general public to reinforce the global “space security awareness” campaign referenced above. Effective public diplomacy will be key to garnering the kind of broad-based political support that will ultimately be needed to respond effectively to growing space security challenges.
- *Build Space TCBMs with Like-minded Partners.* Presently, some countries are calling for a treaty banning weapons in space or a treaty preventing an arms race in outer space. Others focus on promoting a code of conduct and the responsible use of space. Europe and the U.S. should continue to take the lead in promoting safe and sustainable space-related activities. The U.S. can advance this effort through its unmatched space capabilities, initially through comprehensive implementation of its SSA Data Sharing Program. Europe can, in turn, apply its long-standing experience in mediating stabilisation arrangements in multilateral bodies to advance specific TCBM measures for space. Space security can, thereby, be advanced faster as trust among space-faring nations could be more easily established. The EU and ESA could offer an overarching cooperative structure to coordinate the Member States (MS). Such a structure could embody advanced and funded SSA, Galileo and other architectures necessary for the implementation of bolder TCBMs in the future.
- *Strengthen Debris Mitigation Regime.* The IADC Guidelines were accepted by the COPUOS in June 2007 and endorsed by the UN General Assembly in February 2008 (UNGA Res. 62/217). The U.S., China, Russia, Japan, and Europe have in place debris mitigation guidelines. Given that these guidelines are voluntary and lack any verification or enforcement mechanisms, there is inconsistent compliance. Select UN members could be prompted to develop national standards for applying the IADC guidelines. Countries can also address the orbital debris concern through: unilateral actions (e.g. enforcement of space debris technical standards; fine non-compliance, etc.); bilateral actions (e.g. improved cooperation on mechanisms to exchange data and work toward interoperable SSA); and multilateral actions (e.g. encourage the UN to strengthen compliance requirements with its voluntary regime).
- *Improve Information Exchanges Related to Collision Avoidance.* Governments could seek to implement national standards, in part, through closer collaboration with industry which spearheaded establishment of a prototype multi-partner collision avoidance system. Data exchanges could be geared to improving

space object databases; establishing common international data standards and data harmonisation; and cooperating on dissemination of orbital tracking information and formulating predictive modelling tools. Moreover, an institutionalized structure should be contemplated to facilitate smoother interface among Member States, the EU, industry and the Space Data Association.

- *TCBM Measures to Mitigate Interference with Space Activities.* This objective could be advanced via establishment of an International Interference Information Centre and similar structures for priority concerns. For example, strengthening of the Consultative Committee for Space Data Systems (CCSDS) offers an opportunity for more effective exchanges of data among space operators. This could, in turn, lead to greater government and commercial interoperability and mutual support. This kind of venue was proposed at the COPUOS in early 2010 in the context of its work on "Preliminary Reflections on Long-term Sustainability of Outer Space Activities".²⁰⁷
- *Avoid Space Becoming an Area of Conflict.* Countries could re-orient their attention from debates on prevention of an arms race in outer space (where little progress is expected in the near term) to individual declarations, gestures, and actions that make clear their peaceful intent in space. This could be accomplished through the timely sharing of space, national security and defence policies; bilateral visits during important, defence-related occasions, and even bilateral and multilateral military exercises testing the potential interoperability of deterrent space capabilities. The Schriever Wargame series could serve as a useful template for such military to military exchanges.
- *Improve Compliance with OST and Other Obligations.* Individual space-faring nations could strengthen oversight of non-governmental entities in space through stricter technical standards, licensing requirements and financial penalties in cases of non-compliance. Nations should request consultations when planning to conduct riskier activities in space. A standing body should be considered to

facilitate compliance with OST obligations. UN members could likewise be urged to seek sanctions for those nations that do not comply and/or endanger the space activities of other nations.

- *Financial Sanctions and Other Disciplinary Measures for Violators.* Nations with stakes in space could establish a system that could be employed on an ad hoc, case-by-case basis which could approve specific penalties for violators of the provisions of the OST and other space treaties and established principles for the safe and sustainable use of space. Such a system could be triggered by the abused party which could, in turn, "multinationalise" the response (if deemed meritorious), thereby making an escalatory spiral less likely. The disciplining measures could include financial sanctions and other tools, including curtailing access to space technology and related transfers.
- *Launch Dialogue on Implementation of Code of Conduct for Outer Space.* There have been a number of proposals concerning the need for a code of conduct to promote the responsible use of space. Specific guidelines, however, still need to be adopted multilaterally, beyond the successful adoption of the Space Debris Mitigation Guidelines. Areas that need close attention are international space situational awareness (SSA) for collision avoidance, radio-frequency interference prevention, and counterspace deterrence and penalties.
- *General Reciprocity Check List.* Create a list of individual steps that each state involved in a specific TCBM needs to follow before judging the character of a specific space activity to ensure the protection of national security space information and avoid unwarranted accusations of TCBM non-compliance.
- *Mutually Reinforcing Space Capabilities.* Certain countries possess a diversified and integrated technology base and advanced hardware that permit them to be largely self-sufficient in space. Other countries are self-sufficient only with regard to specific missions. The latter category of states relies on others to offset their shortfalls in order to fulfil their broader national requirements. A nation's confidence can be undermined by their inability to participate in space activities without the assistance of others, uncertainty concerning access to necessary space technologies and the lack of space-based information. Access to, and the

²⁰⁷ United Nations Committee on the Peaceful Uses of Outer Space. Item 14 on the draft provisional agenda of the Scientific and Technical Subcommittee entitled "Long-term sustainability of outer space activities: Preliminary reflections". UN Doc. A/AC.105/C.1/2010/CRP.3 of 8 Feb. 2010. Vienna: United Nations.



benefits deriving from, space could be provided in exchange for cooperation and information-sharing relevant to space safety and security.

Specific Measures

- *Establish International Centre for Sharing SSA Data.* In order to mitigate collision risks, space operators need: awareness of near-term situations; orbital paths; and propagation ability. A new Data Centre could improve communications among operators as well as between governments and operators through the coordinated tracking of space objects.²⁰⁸ Such a centre could also coordinate collision avoidance activities by integrating various sources of SSA data, including ground- and space-based space surveillance networks (SSN), space observers²⁰⁹ and satellite operators. This concept has already been suggested²¹⁰, and even partially implemented. A prototype Data Centre was established by seven major commercial owners and operators which regularly contribute data from some 120 satellites in GEO orbit.²¹¹ An important next step should be to identify and institutionalise the best means of coordinating, on an ongoing basis, with the Joint Space Operations Center (JSpOC) in the U.S. to take advantage of the overlapping of missions and value-added capabilities.

A fully functional Data Centre would: help augment existing U.S. TLE data with precision orbit data and manoeuvre plans; facilitate sharing orbital element and/or

ephemeris data in different formats by operators through conducting data conversion and reformatting tasks; establish common usage and terminology; develop unified operational protocols to handle routine and emergency situations; exchange protocols on a continuous basis; facilitate operator personnel contact information and establish a strict policy to secure the privacy of the data provided.

- *Institutionalise Guidelines for Information-Sharing on Interference Events.* Satellite or Earth-based terminal-originated satellite radiofrequency interference currently produces thousands of cases annually. Causes of radiofrequency interference include: faulty equipment; the proximity of equipment both on Earth and in space; and problems with the transfer mechanism of the signal. The operational challenges grow substantially with the increasing number of satellites (resulting in decreased physical separation between satellites), terminals on the ground (and their smaller size and mobility) and new suppliers, and the uneven quality of operators' skills.²¹²

Standardisation could be accomplished in the area of training and certification of relevant employees; a requirement for manufacturers of antenna to include the "carrier identification" (ID) technology in their equipment; and formalising and facilitating the information-sharing process concerning interference events. This could also involve creation of a RF interference database that could include satellite location and configuration information as well as reference emitters.²¹³ Commercial operators have already launched a project called the Satellite Operators' Radiofrequency Interference Initiative, but this initiative will eventually need to be more institutionalised.

- *Develop a Counterspace Crisis Management Centre.* Although space has not, thus far, experienced a large-scale, purposeful disruption or damage of one nation's space assets by another, this could well change in the period ahead. Jamming, directed energy weapons, ground-based and potentially space-based ASATs and other counterspace capabilities are, in some cases, already in place and ready for use. It would, therefore, be prudent to anticipate such future abuses or incidents by engaging in pre-crisis planning, including the choreographed

²⁰⁸ During special activities, such as satellite relocations and transfer orbit missions, commercial operators exchange data with other commercial and government operators whose satellites are near or adjacent. The exchanged data include: latest location information, near-term manoeuvre plans, frequency and contact information for further follow-up. However, the existing system needs improvement due to structural flaws. These include: lack of agreed standards for TLE modelling; inadequate accuracy of TLE data for credible collision detection, and insufficient information flow concerning future satellite manoeuvres. Specifically, there needs to be: an improved system of coordination for providing reliable information on future satellite manoeuvres to prevent collision and allow for longer-term prediction of the orbital location of active satellites. This is especially urgent given the advances in propulsion systems and the almost-constant maneuvering of satellites to maintain their orbital position. (DalBello, Richard. "Commercial Efforts to Manage Space Environment." Disarmament Forum 4 (2009).).

²⁰⁹ E.g. Independent Space Observers (ISO) and the International Laser Ranging Service (ILRS)

²¹⁰ See, for example: Cox, Lee-Volker. "Avoiding Collisions in Space: Is it Time for an International Space Integration Center?" Carlisle Barracks: U.S. Army War College (2007).

²¹¹ DalBello, Richard. "Commercial Efforts to Manage Space Environment." Disarmament Forum 4 (2009). 29.

²¹² DalBello, Richard. "Commercial Efforts to Manage Space Environment." Disarmament Forum 4 (2009). 30.

²¹³ Ibid.

series of steps that would be taken in the event of a counterspace attack or incident. This would, in turn, require closer, and more institutionalised, government, industry and military-to-military coordination than has existed in the past and the identification of new avenues for rapid multilateral intervention. The SSA Centre could serve to house this function should a separate Counterspace Centre not be deemed desirable or practical.

EU Code of Conduct-Relevant TCBMs

- *Establish Joint Centre of European Organisations.* Civilian, commercial, and defence systems could be better integrated to provide improved and independent SSA capabilities that could be incorporated into an international structure. For example, the monitoring of close approaches and coordination of manoeuvres is not an adequately established practice of satellite operations due to cost, capability, willingness, or expertise. The EU and/or ESA could configure a collision avoidance notification service to: distribute space weather information; provide launch assistance; mediate manoeuvres among different entities; and provide assistance in emergencies or ambiguous situations. System of systems as envisioned for GEOSS could avoid the requirement for a large facility/staff.
- *Forge Cooperative Venue Among European Militaries.* Lack of coordination among European nations concerning the sharing of space capabilities and intelligence information from satellites leads not only to a reduced effectiveness of military missions, but also to an increased risk of the loss of lives and assets. Accordingly, a European Space Operations Centre, ideally in close coordination with a newly-established NATO structure, could: 1) multiply the effectiveness of individual nation's space assets; 2) create a formalised space security-oriented partnership between the EU/ESA and NATO; and 3) strengthen the existing trans-Atlantic partnership.
- *State Subscribers to EU Code of Conduct Should Lead By Example.* Smaller and emerging space-faring nations would benefit by standards set by an agreed EU Code of Conduct. EU Code of Conduct participants could also take the lead in implementing new space TCBMs as the evolution of more "congested, complex, and competitive" space unfolds.
- *Utilise Special EU Negotiating Skills.* Europe can successfully serve as a

trusted, skilful intermediary in space-related disputes, and even conflicts, among other space powers (e.g. China or Russia and the U.S.). European diplomats have honed such mediation skills for, in some cases, centuries, and have a reputation of calm creativity in bringing other parties to the table and defusing what might otherwise be an escalatory spiral of retaliatory steps in the event of a deliberate or inadvertent "incident". Establishment of a "Space Mediation Board" of leading European space experts in various dimensions of the space security portfolio could become an important resource for global space-faring nations as well as those that aspire to this status.

- *Promote Further Harmonisation of Space Object Registration.* Europe could undertake an initiative to bolster the effectiveness and harmonisation of registration practices based on the Registration Convention and UNGA Resolution 62/101. The Resolution, in part, requires more detailed disclosure in the registration process, leading to greater overall transparency. This particular provision, however, would benefit from a coordinated political intervention aimed at universal implementation.²¹⁴

²¹⁴ The UNOOSA maintains two separate, but complementary, registers on objects launched into outer space. One register collects information provided by States in accordance with UNGA 1721 B (XVI) of Dec 1961, which does not specify detailed information to be provided. The second register collects information provided by States to the Registration Convention. Neither of the registers requires provision of the GSO position. The Registration Convention does not have provision for the "change of ownership" of a space object. The GSO positions are mostly registered with the ITU. As of January 2005, only sixteen out of 45 parties to the Registration Convention had informed the Secretary-General of the establishment of national registers (in accordance with Article II). Multiple launching states, as well as transfer of ownership from one commercial entity to another also complicates the situation. Other issues of registering include: more than one identifier for a space object, different orbital parameters, different time zones, etc. (Schrogl, Kai-Uwe and Niklas Hedman."The UN General Assembly Resolution 62/101 of 17 December 2007 on 'Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects'." *Journal of Space Law*, 34:1 (2008) 145–151.)



Annex: TCBMs in Arms Control and Non-proliferation Endeavours

A.1 Arms Control in the Cold War Context

Name	Summary	Proposed TCBMs
<p>Antarctic Treaty signed: 1959 into force: 1961</p>	<p>The Antarctic Treaty is a multilateral agreement signed in 1959 by – among others – the U.S., the Soviet Union, France and the United Kingdom. Today, 48 states are treaty members. In the treaty, the signatory parties agreed to demilitarise Antarctica and use it only for peaceful purposes and research. It also contains provisions for scientific cooperation.²¹⁵</p>	<p>Transparency Article I 1. Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military manoeuvres, as well as the testing of any type of weapons.</p> <hr/> <p>Consultation Article IX 1. Representatives of the Contracting Parties named in the preamble to the present Treaty shall meet [...] at suitable intervals and places, for the purpose of exchanging information, consulting together on matters of common interest pertaining to Antarctica, and formulating and considering, and recommending to their Governments, measures in furtherance of the principles and objectives of the Treaty [...]</p> <p>Article XI 1. If any dispute arises between two or more of the Contracting Parties concerning the interpretation or application of the present Treaty, those Contracting Parties shall consult among themselves with a view to having the dispute resolved by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement or other peaceful means of their own choice.</p> <hr/> <p>Notification Article III 1. In order to promote international cooperation in scientific investigation in Antarctica, [...] the Contracting Parties agree that, to the greatest extent feasible and practicable: (a) information regarding plans for scientific programs in Antarctica shall be exchanged to permit maximum economy and efficiency of operations;</p> <p>Article VII 5. Each Contracting Party shall [...] inform the other Contracting Parties, and [...] shall give them notice in advance, of (a) all expeditions to and within Antarctica, on the part of its ships of nationals, and all expeditions to Antarctica organized in or proceeding from its territory; (b) all stations in Antarctica occupied by its nationals; and (c) any military personnel or equipment intended to be introduced by it into Antarctica [...].</p> <hr/> <p>Access Article VII 1. In order to promote the objectives and ensure the observation of the provisions of the present Treaty, each Contracting Party [...] shall have the right to designate observers to carry out any inspection provided for by the present Article. [...] 2. Each observer [...] shall have complete freedom of access at any time to any or all areas of Antarctica. 3. All areas of Antarctica, including all stations, installations and equipment within those areas, and all ships and aircraft at</p>

²¹⁵ "The Antarctic Treaty." National Science Foundation – Office of Polar Programs. 19 July 2010. <<http://www.nsf.gov/od/opp/antarct/antrtry.jsp>>.



		<p>points of discharging or embarking cargoes or personnel in Antarctica, shall be open at all times to inspection by any observers [...].</p> <p>4. Aerial observation may be carried out at any time over any or all areas of Antarctica by any of the Contracting Parties having the right to designate observers.</p>
<p>SALT 1 and SALT 2 first talks: 1969–72 second talks: 1977–79</p>	<p>SALT I was the first series of Strategic Arms Limitation Talks that took place from November 1969 - May 1972 and resulted in two agreements between Washington and Moscow: the Anti-ballistic Missile (ABM) Treaty and Interim Agreement on strategic offensive arms. The Interim Agreement imposed a halt on the number of launchers for ICBMs and SLBMs that the U.S. and USSR could deploy.²¹⁶ These agreements were followed by seven years of negotiations, concluded in Vienna in 1979 by signing the Strategic Arms Limitation Treaty (SALT II) that limited the number of launchers and the number of missiles that could be armed with multiple warheads. However, the Treaty did not place limits on the total number of warheads that could be carried on delivery vehicles and the Strategic Arms Limitation Treaty (SALT II) was never ratified.</p>	<p>Information Article XVII 3. In the Standing Consultative Commission the Parties shall maintain by category the agreed data base on the numbers of strategic offensive arms [...].</p> <hr/> <p>Consultation Article XVII 1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall use the Standing Consultative Commission [...].</p> <hr/> <p>Notification Article XVI 1. Each Party undertakes, before conducting each planned ICBM launch, to notify the other Party well in advance on a case-by-case basis that such a launch will occur [...].</p> <hr/> <p>Constraint Article I Each Party undertakes, in accordance with the provisions of this Treaty, to limit strategic offensive arms quantitatively and qualitatively, to exercise restraint in the development of new types of strategic offensive arms, and to adopt other measures provided for in this Treaty.</p> <p>Article IX 1. Each Party undertakes not to develop, test, or deploy: (c) systems for placing into Earth orbit nuclear weapons or any other kind of weapons of mass destruction, including fractional orbital missiles;</p> <p>Article XV 1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law. 2. Each party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article. 3. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices. [...]</p> <p>Second Common Understanding. Each Party is free to use various methods of transmitting telemetric information during testing, including its encryption, except that, in accordance with the provisions of paragraph 3 of Article XV of the Treaty, neither Party shall engage in deliberate denial of telemetric information, such as through the use of telemetry encryption, whenever such denial impedes verification of compliance with the provisions of the Treaty.</p>
<p>Incidents at Sea Agreement signed: 1972 into force: 1972</p>	<p>A bilateral agreement signed by the United States and the Soviet Union in 1972 after talks in 1971. The Agreement provides for implementation of a variety of procedures so as to avoid dangerous close quarter incidents at sea. It likewise aims at preventing esca-</p>	<p>Transparency Article II The Parties shall take measures to instruct the commanding officers of their respective ships to observe strictly the letter and spirit of the International Regulations for Preventing Collisions at Sea, hereinafter referred to as the Rules of the Road. [...]</p> <hr/> <p>Notification Article VI Both Parties shall:</p>

²¹⁶ At the time, the U.S. had 1,054 and the USSR had 1,618 ICBM launchers.

	<p>tion in the event of incidents.</p>	<p>1. Provide through the established system of radio broadcasts of information and warning to mariners, not less than 3 to 5 days in advance as a rule, notification of actions on the high seas which represent a danger to navigation or to aircraft in flight.</p> <p>Additional agreement from 23 May 1973, Article I The Parties shall take measures to notify the non-military ships of each Party on the provisions of the Agreement directed at securing mutual safety.</p> <hr/> <p>Constraint Article III</p> <p>2. Ships meeting or operating in the vicinity of a formation of the other Party shall, while conforming to the Rules of the Road, avoid maneuvering in a manner which would hinder the evolutions of the formation.</p> <p>4. Ships engaged in surveillance of other ships shall stay at a distance which avoids the risk of collision and also shall avoid executing maneuvers embarrassing or endangering the ships under surveillance. Except when required to maintain course and speed under the Rules of the Road, a surveillant shall take positive early action so as, in the exercise of good seamanship, not to embarrass or endanger ships under surveillance.</p> <p>6. Ships of the Parties shall not simulate attacks by aiming guns, missile launchers, torpedo tubes, and other weapons in the direction of a passing ship of the other Party, not launch any object in the direction of passing ships of the other Party, and not use searchlights or other powerful illumination devices to illuminate the navigation bridges of passing ships of the other Party.</p> <p>Additional agreement from 23 May 1973, Article II Ships and aircraft of the Parties shall not make simulated attacks [...] at non-military ships of the other Party, nor launch nor drop any objects near non-military ships of the other Party in such a manner as to be hazardous to these ships or to constitute a hazard to Navigation.</p>
<p>Anti Ballistic Missile Treaty signed: 1972 into force: 1972</p>	<p>The ABM Treaty banned testing and deployment of space-based, sea-based, or air-based ABM systems and components, as well as imposed a number of qualitative limits on missile defence programmes. The 1974 Protocol determined that the U.S. and Soviet Union would deploy an ABM system only at one site each.²¹⁷ The restriction excluded defences against aircraft, cruise missiles, or theatre ballistic missiles.²¹⁸ The ABM Treaty pioneered cooperation and restraint that helped prevent direct military confrontation.²¹⁹ In 2002, the U.S. withdrew from the ABM Treaty.</p>	<p>Space-related content Article V</p> <p>1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.</p> <hr/> <p>Consultation Article XIII</p> <p>1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall establish promptly a Standing Consultative Commission, within the framework of which they will:</p> <p>(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;</p> <p>(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;</p> <p>(c) consider questions involving unintended interference with national technical means of verification; [...]</p> <hr/> <p>Verification/Constraint Article XII</p> <p>1. For the purpose of providing assurance or compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international</p>

²¹⁷ The USSR deployed its site around Moscow and it remains operational till today. The U.S. deployed its ABM system around ICBM silo launchers near Grand Forks North Dakota, which is closed now.

²¹⁸ Woolf, Amy F., Mary Beth Nikitin, and Paul K. Kerr: "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements". Congressional Research Service 2 Feb. 2010. 5.

²¹⁹ Clay Moltz, James. "The Emergence of Cooperative Restraint." The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests. Stanford: Stanford University Press, 2008. 174.



		<p>law. 2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.</p> <p>Agreed Statement [F] The Parties agree not to deploy phased-array radars [...] except for the purposes of tracking objects in outer space or for use as national technical means of verification.</p>
<p>Intermediate-Range Nuclear Forces Treaty (INF) signed: 1987 into force: 1988</p>	<p>The INF Treaty obliged the U.S. and Soviet Union to eliminate and permanently abandon all their intermediate-range and shorter-range nuclear-armed ballistic missiles and ground-launched cruise missiles with ranges of 500–5,500 km, as well as the launchers associated with the controlled missiles. For the first time, the two powers agreed on elimination of an entire category of nuclear weapons and on-site inspections for verification.²²⁰ In 2007, Russia threatened to withdraw from the INF, partially due to U.S. plans to deploy a “Third Site” missile defence system in Central Europe.</p>	<p>Information Article IX 1. The Memorandum of Understanding contains categories of data relevant to obligations undertaken with regard to this Treaty and lists all intermediate-range and shorter-range missiles, launchers of such missiles, and support structures and support equipment associated with such missiles and launchers, possessed by the Parties as of November 1, 1987. Updates of that data and notifications required by this Article shall be provided according to the categories of data contained in the Memorandum of Understanding.</p> <hr/> <p>Consultation Article XIII 1. To promote the objectives and implementation of the provisions of this Treaty, the Parties hereby establish the Special Verification Commission. The Parties agree that, if either Party so requests, they shall meet within the framework of the Special Verification Commission to: (a) resolve questions relating to compliance with the obligations assumed; and (b) agree upon such measures as may be necessary to improve the viability and effectiveness of this Treaty.</p> <hr/> <p>Notification Article IX 5. Upon entry into force of this Treaty and thereafter, each Party shall provide the following notifications to the other Party: [e.g. elimination of missile operating base]</p> <hr/> <p>Constraint Article I [...] [E]ach Party shall eliminate its intermediate-range and shorter-range missiles, not have such systems thereafter, and carry out the other obligations set forth in this Treaty.</p> <p>Article XII 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law. 2. Neither Party shall: (a) interfere with national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article; or (b) use concealment measures which impede verification of compliance with the provisions of this Treaty by national technical means of verification carried out in accordance with paragraph 1 of this Article. [...]</p> <hr/> <p>Access Article XI 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, each Party shall have the right to conduct on-site inspections. The Parties shall implement on-site inspections in accordance with this Article, the Protocol on Inspection and the Protocol on Elimination.</p>
<p>START 1</p>	<p>The START Agreement,</p>	<p>Transparency</p>

²²⁰ The warheads and guidance systems of the missiles needed not be destroyed. 2,692 short-, medium-, and intermediate-range missiles had been destroyed by June 1991.

<p>signed: 1991 into force: 1994</p>	<p>negotiated for almost a decade, and signed in July 1991, by President George H. W. Bush and Soviet President Mikhail Gorbachev, was the first agreement between the U.S. and Soviet Union to reduce the number of nuclear weapons. The agreement obliged the Soviet Union to destroy more than 3,000 ballistic missiles, 45 atomic submarines and more than 65 strategic bombers. The U.S. destroyed more than 3,000 missiles, and a significant number of launchers and bombers.²²¹ After the fall of the Soviet Union, four independent states were in possession of strategic nuclear weapons: Russia, Belarus, Ukraine, and Kazakhstan. In 1992, the United States and the four nuclear-capable successor states to the Soviet Union signed the "Lisbon Protocol," which makes all five nations party to the START I agreement. This agreement entered into force December 5, 1994. START 1 expired in 2009.</p>	<p>Article VII 6. Except as otherwise provided in this Article, each Party shall have the right to release to the public all data current as of September 1, 1990, that are listed in the Memorandum of Understanding, as well as the photographs that are appended thereto. [...] The Parties shall hold consultations on releasing to the public data and other information provided pursuant to this Article or received otherwise in fulfilling the obligations provided for in this Treaty. [...]</p> <hr/> <p>Notification Article VIII 1. A data base pertaining to the obligations under this Treaty is set forth in the Memorandum of Understanding, in which data with respect to items subject to the limitations provided for in this Treaty are listed according to categories of data. 2. In order to ensure the fulfillment of its obligations with respect to this Treaty, each Party shall notify the other Party of changes in data [...]. 3. Each Party shall provide to the other Party, in accordance with the Notification Protocol, and, for subparagraph (i) of this paragraph, in accordance with Section III of the Inspection Protocol: [...] [subparagraphs (a) to (j) detail notification requirements]</p> <hr/> <p>Consultation Article XV To promote the objectives and implementation of the provisions of this Treaty, the Parties hereby establish the Joint Compliance and Inspection Commission. The Parties agree that, if either Party so requests, they shall meet within the framework of the Joint Compliance and Inspection Commission to: (a) resolve questions relating to compliance with the obligations assumed; (b) agree upon such additional measures as may be necessary to improve the viability and effectiveness of this Treaty; and (c) resolve questions related to the application of relevant provisions of this Treaty to a new kind of strategic offensive arm, after notification has been provided in accordance with paragraph 16 of Section VII of the Notification Protocol. Article XVI [...] The Parties shall hold consultations in accordance with Article XV of this Treaty in order to resolve any ambiguities that may arise in this regard. [...]</p> <p>Thirtieth Agreed Statement [...] Should the Parties reach agreement concerning the possibility of using ICBMs and SLBMs for delivering objects into the upper atmosphere or space from waterborne vehicles other than submarines or from such airplanes, provisions concerning procedures for such launches shall be agreed within the framework of the Joint Compliance and Inspection Commission. [...]</p> <hr/> <p>Constraint Article IV 4. For ICBMs and SLBMs used for delivering objects into the upper atmosphere or space: (a) Each Party shall limit the number of space launch facilities to no more than five, unless otherwise agreed. Space launch facilities shall not overlap ICBM bases. (b) Each Party shall limit the aggregate number of ICBM launchers and SLBM launchers located at space launch facilities to no more than 20, unless otherwise agreed. Article V 14. Each Party undertakes not to flight-test from space launch facilities ICBMs or SLBMs equipped with reentry vehicles.</p>
--	--	---

²²¹ "Strategic Arms Limitation Talks 2009." Background Information Summaries. Great Neck Publishing. 1.



		<p>15. Each Party undertakes not to use ICBMs or SLBMs for delivering objects into the upper atmosphere or space for purposes inconsistent with existing international obligations undertaken by the Parties.</p> <p>18. Each Party undertakes not to produce, test, or deploy: (c) systems, including missiles, for placing nuclear weapons or any other kinds of weapons of mass destruction into Earth orbit or a fraction of an Earth orbit;</p>
<p>Strategic Offensive Reductions' Treaty signed: 2002 into force: 2003</p>	<p>In May 2002, Presidents George W. Bush and Vladimir Putin signed the Moscow Treaty on Strategic Offensive Reductions. It supplemented the 1991 START agreement and called for further reductions in both warheads and delivery systems by two-thirds (warheads to between 1,700 and 2,200 by December 2012). Each side were to determine its "strategic forces", i.e. delivery systems, consistent with the reduced number of warheads. It likewise established a bilateral Implementation Commission to meet twice a year to discuss issues that might arise.</p>	<p>Consultation Article III For purposes of implementing this Treaty, the Parties shall hold meetings at least twice a year of a Bilateral Implementation Commission.</p>
<p>New START signed: 2010 into force: not yet</p>	<p>A new Strategic Arms Limitation Agreement was signed by Presidents Barack Obama of the U.S. and Dmitry Medvedev of Russia in April 2010, replacing the expired 1991 START agreement as well as the 2002 Moscow Treaty, and following a non-binding agreement of 2009. The 2010 version agreed to reduce the number of deployed nuclear warheads to 1,550 and the number of delivery vehicles (ICBMs, submarines and bombers) to 800 (down from 1,600 under the START agreement). The new totals of nuclear warheads represented a 74% reduction from the 1991 START treaty and a 30% reduction from the 2002 Moscow Treaty limits. An inspection programme was also included. This new accord still needs ratification by legislators in both countries. The new treaty covers only strategic nuclear weapons, not "tactical" nuclear weapons or strategic warheads held in reserve.²²²</p>	<p>Transparency Article VII 1. A database pertaining to the obligations under this Treaty shall be created [...]. 5. The Parties shall hold consultations within the framework of the Bilateral Consultative Commission on releasing to the public data and information obtained during the implementation of this Treaty. The Parties shall have the right to release to the public such data and information following agreement thereon within the framework of the Bilateral Consultative Commission. Each Party shall have the right to release to the public data related to its respective strategic offensive arms.</p> <p>Article XI 4. Each Party shall conduct exhibitions and have the right to participate in exhibitions conducted by the other Party. The purpose of such exhibitions shall be to demonstrate distinguishing features and to confirm technical characteristics of new types, and to demonstrate the results of conversion of the first item of each type of strategic offensive arms subject to this Treaty.</p> <p>Information Article VII 7. Notwithstanding paragraph 5 of this Article, the aggregate numbers of deployed ICBMs, deployed SLBMs, and deployed heavy bombers; the aggregate numbers of warheads on deployed ICBMs, deployed SLBMs, and nuclear warheads counted for deployed heavy bombers; and the aggregate numbers of deployed and non-deployed ICBM launchers, deployed and non-deployed SLBM launchers, and deployed and non-deployed heavy bombers, may be released to the public by the Parties.</p> <p>Article VIII In those cases in which one of the Parties determines that its actions may lead to ambiguous situations, that Party shall take measures to ensure the viability and effectiveness of this</p>

²²²

"Strategic Arms Limitation Agreement 2010". Background Information Summaries. Great Neck Publishing.

		<p>Treaty and to enhance confidence, openness, and predictability concerning the reduction and limitation of strategic offensive arms. Such measures may include, among other things, providing information in advance on activities of that Party associated with deployment or increased readiness of strategic offensive arms, to preclude the possibility of misinterpretation of its actions by the other Party. This information shall be provided through diplomatic or other channels.</p> <hr/> <p>Notification Article IV 11. [...] Heavy bombers may be temporarily located outside the national territory, notification of which shall be provided in accordance with Part Four of the Protocol to this Treaty.</p> <p>Article VI 2. Notifications related to conversion, elimination, or other means for removal from accountability shall be provided in accordance with Parts Three and Four of the Protocol to this Treaty.</p> <p>Article VII 2. Each Party shall notify the other Party about changes in data and shall provide other notifications in a manner provided for in Part Four of the Protocol to this Treaty. 4. Each Party may provide additional notifications on a voluntary basis, in addition to the notifications specified in paragraph 2 of this Article, if it deems this necessary to ensure confidence in the fulfillment of obligations assumed under this Treaty.</p> <hr/> <p>Verification/Constraint Article VI 3. Verification of conversion or elimination in accordance with this Treaty shall be carried out by: (a) national technical means of verification in accordance with Article X of this Treaty;</p> <p>Article X 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, each Party undertakes: (a) to use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law; (b) not to interfere with the national technical means of verification of the other Party operating in accordance with this Article; and (c) not to use concealment measures that impede verification, by national technical means of verification, of compliance with the provisions of this Treaty.</p> <hr/> <p>Access Article XI 1. For the purpose of confirming the accuracy of declared data on strategic offensive arms subject to this Treaty and ensuring verification of compliance with the provisions of this Treaty, each Party shall have the right to conduct inspection activities in accordance with this Article and Part Five of the Protocol to this Treaty. [...]</p>
--	--	--

A.2 Multilateral Nuclear Non-Proliferation Efforts

Name	Summary	Proposed TCBMs
Nuclear Non-Proliferation Treaty signed: 1968 into force: 1970	The NPT involves 189 states as signatories and obligates the five acknowledged nuclear-weapon states (NWS) not to transfer nuclear	Consultation Article VIII 3. [...] At intervals of five years thereafter, a majority of the Parties to the Treaty may obtain, by submitting a proposal to this effect to the Depositary Governments, the convening of



	<p>weapons, other nuclear explosive devices and/or their technology to non-nuclear-weapon states (NNWS). NNWS are not allowed to receive, acquire, and manufacture nuclear weapons or other nuclear explosive devices. All their nuclear material for peaceful activities must be under the IAEA safeguard. Moreover, all signatories are to actively work toward nuclear disarmament. The UN Security Council Resolution (UNSCR) 255 of June 1968 on security assurances to NPT NNWS accompanied the NPT. Also, UNSCR 984 of April 1995 issued harmonised negative security assurances by NWS for NNWS parties to the NPT.²²³</p>	<p>further conferences with the same objective of reviewing the operation of the Treaty.</p> <hr/> <p>Access Article III 1. Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty [...]</p>
<p>IAEA established: 1957</p>	<p>The IAEA, established in 1957, has two primary functions: to assist nations in their peaceful nuclear programmes and to prevent nuclear materials to be diverted to nuclear weapons uses. The IAEA safeguard system represents a transparency set of steps: data collection, review and periodic inspections at facilities, declared as well as those undeclared in which a weapons-related activities are suspected.</p> <p>The NPT members have an obligation to declare and submit all nuclear materials they possess to regular IAEA inspections. Some NPT non-members, who are members of the IAEA, allow inspections of select nuclear facilities.</p>	<p>Information Article VIII: Exchange of information A. Each member should make available such information as would, in the judgement of the member, be helpful to the Agency . B. Each member shall make available to the Agency all scientific information developed as a result of assistance extended by the Agency pursuant to article XI. C. The Agency shall assemble and make available in an accessible form the information made available to it under paragraphs A and B of this article. It shall take positive steps to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose.</p> <hr/> <p>Consultation Article XVII: Settlement of disputes A. Any question or dispute concerning the interpretation or application of this Statute which is not settled by negotiation shall be referred to the International Court of Justice in conformity with the Statute of the Court, unless the parties concerned agree on another mode of settlement.</p> <hr/> <p>Access Article XII: Agency safeguards A. [...] [T]he Agency shall have the following rights and responsibilities to the extent relevant to the project or arrangement: 1. To examine the design of specialized equipment and facilities, including nuclear reactors, and to approve it only from the view- point of assuring that it will not further any military purpose, that it complies with applicable health and safety standards, and that it will permit effective application of the safeguards provided for in this article; 6. To send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, who shall have access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment, or facilities which are required by this Statute to be safeguarded, as necessary to account for source and special fissionable materials supplied and fissionable products [...].</p>

²²³ "Treaty on the Non-Proliferation of Nuclear Weapons." 11 Jan. 2010. Inventory of International Nonproliferation Organizations and Regimes. Center for Nonproliferation Studies. 1-2. 05 Jul. 2010. <http://www.nti.org/e_research/official_docs/inventory/pdfs/npt.pdf>.

<p>Nuclear Weapon Free Zones</p>	<p>Nuclear-weapons-free area idea first surfaces in the late 1950's with Poland offering the first proposal, the Rapacki Plan, which sought to initially keep nuclear weapons from being deployed in Poland, Czechoslovakia, West and East Germany. Other proposals were made by the Soviet Union, Sweden, Finland, Romania and Bulgaria, but they never materialised in the Cold War environment.</p> <p>The right to create NWFZ designated to be free of manufacturing, acquiring, testing, or possessing nuclear weapons, with the exception of nuclear energy for peaceful purposes, was described in the Article VII of the NPT and reaffirmed by the UN General Assembly in 1975. There are five NWFZ established by individual treaties.²²⁴ However, three of these treaties include provisions allowing for the ability of transfer of NW through these zones. Each NWFZ treaty includes so-called negative security assurances, a legally-binding protocol calling upon the NWS to respect the status of the zones and not to use or threaten to use nuclear weapons against treaty-based parties.</p> <p>Should state parties wish to withdraw, they need to provide a one-year advance notice (with the exception of the Tlatelolco Treaty requiring three months' advance notice). The members adopted comprehensive safeguards for verifying non-engagement in illicit nuclear weapons programme are managed by the IAEA. The Central Asian NWFZ further requires that states in the region adopt the IAEA's Additional Protocol providing for expanded monitoring.</p> <p>The Central Asian NWFZ goes a step further in requiring that states in the region adopt the IAEA's Additional Protocol, which</p>	<p>TCBMs taken from the South Pacific Nuclear Free Zone Treaty from 1985</p> <hr/> <p>Information Article 9 1. Each Party shall report to the Director of the South Pacific Bureau for Economic Co-operation (the Director) as soon as possible any significant event within its jurisdiction affecting the implementation of this Treaty. The Director shall circulate such reports promptly to all Parties.</p> <hr/> <p>Consultation Article 10 Without prejudice to the conduct of consultations among Parties by other means, the Director, at the request of any Party, shall convene a meeting of the Consultative Committee established by Annex 3 for consultation and co-operation on any matter arising in relation to this Treaty or for reviewing its operation.</p> <hr/> <p>Constraint Article 3 Each Party undertakes: (a) not to manufacture or otherwise acquire, possess or have control over any nuclear explosive device by any means anywhere inside or outside the South Pacific Nuclear Free Zone; (b) not to seek or receive any assistance in the manufacture or acquisition of any nuclear explosive device; (c) not to take any action to assist or encourage the manufacture or acquisition of any nuclear explosive device by any State.</p> <p>Article 6 Each Party undertakes: (a) to prevent in its territory the testing of any nuclear explosive device;</p> <hr/> <p>Access 1. The Parties hereby establish a control system for the purpose of verifying compliance with their obligations under this Treaty. 2. The control system shall comprise: [...] (c) the application to peaceful nuclear activities of safeguards by the IAEA as provided for in Annex 2;</p>
---	---	---

²²⁴ Four of these five zones are in the Southern Hemisphere. The regions under NWFZ agreements include: Latin America (the 1967 Treaty of Tlatelolco), the South Pacific (the 1985 Treaty of Rarotonga), Southeast Asia (the 1995 Treaty of Bangkok) Africa (the 1996 Treaty of Pelindaba) and Central Asia (the 2006 Treaty of Semipalatinsk).



	<p>provides for expanded monitoring. The territory covered includes the land, internal waters, territorial seas and archipelagic waters. However, disputes exist concerning the validity of these treaties on sea, the “freedom at sea” principle, and archipelagic waters (i.e. the Chagos Archipelago which includes a U.S. military base).</p>	
<p>Fissile Material Production Cutoff Treaty process started: 1993</p>	<p>The NPT did not provide for production of fissile material usable for nuclear weapons and accordingly, a fissile material production ban was proposed by the U.S. and has been negotiated, so far unsuccessfully, at the Conference on Disarmament (CD). In 1995, the CD agreed on so-called “Shannon Mandate”, seen by some states as the basis for future negotiations. It proposed that an ad hoc committee in charge of negotiations would settle existing issues. However, no negotiations, as yet, have begun.²²⁵</p>	<p>Information IV.1. Each State Party undertakes to publish, annually update and present to the Conference of States Parties national inventories of all fissile materials, in its possession or under its control, by category: in civilian, nuclear-weapon and military non-explosive use.</p> <p>Consultation VIII.1. Disputes that may arise concerning the application or the interpretation of this Treaty which cannot be settled under the Statute of the IAEA, shall be settled in accordance with the relevant provisions of this Treaty and in conformity with the provisions of the Charter of the United Nations.</p> <p>Constraint I.1. Each State Party undertakes not to produce fissile material for nuclear weapons or other nuclear explosive devices. I.2. Each State Party undertakes not to acquire from any source or to transfer to any recipient fissile material for nuclear weapons or other nuclear explosive devices; I.3 Each State Party undertakes not to assist, induce or encourage in any way anyone to engage in any activity prohibited under this Treaty; VI.2. In cases where a State Party has been requested by the Conference to redress a situation raising problems with regard to its compliance and fails to fulfil the request within the specified time, the Conference may, inter alia, decide to restrict or suspend the State Party from the exercise of its rights and privileges under this Treaty until the Conference decides otherwise.</p> <p>Access III.1. Each State Party undertakes to accept IAEA safeguards to verify its obligations under Article I as described in this Article.</p>
<p>Nuclear Suppliers Group established: 1974</p>	<p>NSG is an informal association with a goal to control nuclear-related exports on an international basis. NSG members voluntarily agree to coordinate exports of civilian nuclear material and nuclear-related equipment and technology to non-nuclear states. The guidelines for export include lists of materials and equipment that are subject to export controls. The recipient country is required to offer assurances providing for prevention of usage for a weapons programme, physi</p>	<p>Transparency 10. Notwithstanding other provisions of these Guidelines, suppliers should authorize transfer of items or related technology identified in the trigger list only when they are satisfied that the transfers would not contribute to the proliferation of nuclear weapons or other nuclear explosive devices or be diverted to acts of nuclear terrorism. 12. Suppliers should promote international co-operation in the areas of physical security through the exchange of physical security information, protection of nuclear materials in transit, and recovery of stolen nuclear materials and equipment.</p> <p>Consultation 16. (a) Suppliers should maintain contact and consult through regular channels on matters connected with the implementation of these Guidelines. (b) Suppliers should consult, as each deems appropriate, with other governments concerned on specific sensitive cases, to</p>

²²⁵ Other informal cooperative activities seeking to address nuclear weapons issue include: the Global Threat Reduction Initiative (GTRI); the Proliferation Security Initiative (PSI); the Global Initiative to Combat Nuclear Terrorism; and unilateral and multi-lateral sanctions.

	<p>cal security, transfer to a third party only with the permission of the exporter, and adoption of IAEA safeguards.</p> <p>In September 2008, the NSG agreed to exempt India from the full-scope safeguards requirement, restraining the transfer of enrichment and reprocessing equipment. Like other voluntary mechanisms, the NSG has limited effectiveness as there is lack of verification and enforcement mechanisms.</p>	<p>ensure that any transfer does not contribute to risks of conflict or instability.</p> <hr/> <p>Constraint</p> <p>4. (a) Suppliers should transfer trigger list items or related technology to a non-nuclear weapon State only when the receiving State has brought into force an agreement with the IAEA requiring the application of safeguards on all source and special fissionable material in its current and future peaceful activities. [...]</p>
<p>Convention on the Physical Protection of Nuclear Material adopted: 1979 into force: 1987</p>	<p>The Convention is the only international legally binding undertaking in the area of physical protection of nuclear material. It establishes measures related to the prevention, detection and punishment of offenses relating to nuclear material.</p> <p>A Diplomatic Conference in July 2005 was convened to amend the Convention and strengthen its provisions. The amended Convention makes it legally binding for States Parties to protect nuclear facilities and material in peaceful domestic use, storage as well as transport. It also provides for expanded cooperation between and among States regarding rapid measures to locate and recover stolen or smuggled nuclear material, mitigate any radiological consequences of sabotage, and prevent and combat related offences. The amendments will take effect once they have been ratified by two-thirds of the States Parties of the Convention.²²⁶</p>	<p>Transparency</p> <p>Article 5</p> <p>1. States Parties shall identify and make known to each other directly or through the International Atomic Energy Agency their central authority and point of contact having responsibility for physical protection of nuclear material and for coordinating recovery and response operations in the event of any unauthorized removal, use or alteration of nuclear material or in the event of credible threat thereof.</p> <hr/> <p>Notification</p> <p>Article 14</p> <p>1. Each State Party shall inform the depositary of its laws and regulations which give effect to this Convention. The depositary shall communicate such information periodically to all States Parties.</p> <p>2. The State Party where an alleged offender is prosecuted shall, wherever practicable, first communicate the final outcome of the proceedings to the States directly concerned. The State Party shall also communicate the final outcome to the depositary who shall inform all States.</p> <hr/> <p>Consultation</p> <p>Article 5</p> <p>In the case of theft, robbery or any other unlawful taking of nuclear material or of credible threat thereof, States Parties shall, in accordance with their national law, provide cooperation and assistance to the maximum feasible extent in the recovery and protection of such material to any State that so requests. [...]</p> <p>Article 17</p> <p>1. In the event of a dispute between two or more States Parties concerning the interpretation or application of this Convention, such States Parties shall consult with a view to the settlement of the dispute by negotiation, or by any other peaceful means of settling disputes acceptable to all parties to the dispute.</p> <p>2. Any dispute of this character which cannot be settled in the manner prescribed in paragraph 1 shall, at the request of any party to such dispute, be submitted to arbitration or referred to the International Court of Justice for decision. [...]</p>
<p>International Convention for the Suppression of Acts of Nuclear Terrorism adopted: 2005 into force: 2007</p>	<p>International Convention for the Suppression of Acts of Nuclear Terrorism, also known as the Nuclear Terrorism Convention was adopted in 2005 by the UN General Assembly and came into force in 2007. The U.S.</p>	<p>Transparency/Notification</p> <p>Article 7</p> <p>1. States Parties shall cooperate by: [...]</p> <p>b. Exchanging accurate and verified information in accordance with their national law and in the manner and subject to the conditions specified herein, and coordinating administrative and other measures taken as appropriate to detect, prevent, suppress and investigate the offences set forth in article 2 and</p>

²²⁶ "Convention on the Physical Protection of Nuclear Material." International Atomic Energy Association. 12 July 2010. <<http://www.iaea.org/Publications/Documents/Conventions/cppnm.html>>.



	<p>and Russia were the first countries to sign the document. As of January 2010, the Convention had 115 signatories, including 63 state parties. It was preceded by an eight-year discussion concerning a draft treaty proposed by Russia in 1997, which came to a deadlock when discussing a definition of terrorism and the issue of nuclear weapons use by states. The Convention provides definition of unlawful possession and use of radioactive or nuclear material/devices, and the use or damage to nuclear facilities. It only covers acts by individuals, not states, and commits the signatories to adopt measures in their national laws to criminalise such offences and make them punishable.</p>	<p>also in order to institute criminal proceedings against persons alleged to have committed those crimes. In particular, a State Party shall take appropriate measures in order to inform without delay the other States referred to in article 9 in respect of the commission of the offences set forth in article 2 as well as preparations to commit such offences about which it has learned, and also to inform, where appropriate, international organizations.</p> <hr/> <p>Consultation Article 23 1. Any dispute between two or more States Parties concerning the interpretation or application of this Convention which cannot be settled through negotiation within a reasonable time shall, at the request of one of them, be submitted to arbitration. If, within six months of the date of the request for arbitration, the parties are unable to agree on the organization of the arbitration, any one of those parties may refer the dispute to the International Court of Justice [...].</p> <hr/> <p>Notification Article 7 4. States Parties shall inform the Secretary-General of the United Nations of their competent authorities and liaison points responsible for sending and receiving the information referred to in the present article.</p> <p>Article 9 3. Upon ratifying, accepting, approving or acceding to this Convention, each State Party shall notify the Secretary-General of the United Nations of the jurisdiction it has established under its national law in accordance with paragraph 2 of the present article.</p> <hr/> <p>Constraint Article 22 Nothing in this Convention entitles a State Party to undertake in the territory of another State Party the exercise of jurisdiction and performance of functions which are exclusively reserved for the authorities of that other State Party by its national law.</p>
<p>Proliferation Security Initiative (PSI) from 2003</p>	<p>President Bush announced the Proliferation Security Initiative (PSI) on May 31, 2003. This Initiative is primarily a diplomatic tool developed by the United States to gain support for interdicting shipments of weapons of mass destruction-related (WMD) equipment and materials. The states involved in PSI have agreed to review their national legal authorities for interdiction, provide consent for other states to board and search their own flag vessels, and conclude shipboarding agreements. The Proliferation Security Initiative has no budget, no formal offices supporting it, no international secretariat, and no formal mechanism for measuring its effectiveness (like a database of cases). As of December 2008, the Bush Administration states that 90 nations</p>	<p>Transparency 3. Review and work to strengthen their relevant national legal authorities where necessary to accomplish these objectives, and work to strengthen when necessary relevant international law and frameworks in appropriate ways to support these commitments²²⁸</p> <hr/> <p>Notification 2. Adopt streamlined procedures for rapid exchange of relevant information concerning suspected proliferation activity, protecting the confidential character of classified information provided by other states as part of this initiative, dedicate appropriate resources and efforts to interdiction operations and capabilities, and maximize coordination among participants in interdiction efforts.</p>

	have committed formally to PSI participation. ²²⁷	
Global Threat Reduction Initiative (GTRI) from 2004	U.S. Secretary of Energy Spencer Abraham announced on 26 May 2004 the Global Threat Reduction Initiative. It included provisions to repatriate Russian-origin nuclear fuel, to convert the cores of 105 civilian reactors to use low-enriched uranium, and the repatriation of U.S.-origin research reactor spent high-enriched uranium. Over 90 countries joined this initiative committing to spend around \$450 million in the next ten years. ²²⁹	Constraint - Work in partnership with Russia to repatriate all Russian-origin fresh highly enriched uranium fuel by the end of next year and accelerate and complete repatriation of all Russian-origin spent fuel by 2010; - Take all steps necessary to accelerate and complete repatriation of U.S.-origin research reactor spent fuel from locations around the world within a decade; ²³⁰
Global Initiative to Combat Nuclear Terrorism from 2006	Russia and the U.S. announced in July 2006 the creation of the Global Initiative to Combat Nuclear Terrorism that is – like the PSI -- non-binding. Its aim is to prevent, detect and respond to the threat of nuclear terrorism by improving nations' abilities to secure radioactive material and by sharing best practices to combat nuclear terrorism. 13 states endorsed a Statement of Principles at a meeting in 2006. ²³¹	Transparency 1. Develop, if necessary, and improve accounting, control and physical protection systems for nuclear and other radioactive materials and substances; Information 8. Promote information sharing pertaining to the suppression of acts of nuclear terrorism and their facilitation, taking appropriate measures consistent with their national law and international obligations to protect the confidentiality of any information which they exchange in confidence.
Limited Test Ban Treaty (LTBT) signed: 1963 into force: 1963	Also known as Partial Test Ban Treaty. It bans nuclear weapons tests or any nuclear explosions in the atmosphere, outer space, and under water. It does not prohibit underground testing so long it doesn't affect territories of other states. It was negotiated trilaterally between the U.S., the Soviet Union and the United Kingdom. Until now, more than 110 states signed the treaty including India and Pakistan. France and the People's Republic of China are not part of the treaty. The LTBT was complemented by the threshold test ban treaty (TTBT) and the treaty on peaceful nu-	Constraint Article I 1. Each of the Parties to this Treaty undertakes to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control: (a) in the atmosphere; beyond its limits, including outer space; [...] 2. Each of the Parties to this Treaty undertakes furthermore to refrain from causing, encouraging, or in any way participating in, the carrying out of any nuclear weapon test explosion, or any other nuclear explosion, anywhere which would take place in any of the environments described, or have the effect referred to, in paragraph 1 of this Article.

²²⁷ Woolf, Amy F., Mary Beth Nikitin, and Paul K. Kerr: "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements". Congressional Research Service 2 Feb. 2010. 34–35.

²²⁸ "Interdiction Principles for the Proliferation Security Initiative." 04 Sep. 2003. U.S. Department of State. 26 July 2010. <<http://www.state.gov/t/isn/c27726.htm>>.

²²⁹ Woolf, Amy F., Mary Beth Nikitin, and Paul K. Kerr: "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements". Congressional Research Service 2 Feb. 2010. 33–34.

²³⁰ "This Month. June 2004." U.S. Department of Energy. 26 July 2010.

<http://www.nti.org/e_research/official_docs/doe/doeJune04.pdf>.

²³¹ Woolf, Amy F., Mary Beth Nikitin, and Paul K. Kerr: "Arms Control and Nonproliferation: A Catalog of Treaties and Agreements". Congressional Research Service 2 Feb. 2010. 36.



	<p>clear explosions (PNET) in 1974 and 1976, respectively.</p>	
<p>Threshold Test Ban Treaty (TTBT) signed: 1974 into force: 1990</p>	<p>“The Threshold Test Ban Treaty (TTBT) established a nuclear testing ‘threshold,’ by prohibiting tests having a yield exceeding 150 kilotons (equivalent to 150,000 tons of TNT). The threshold is militarily important since it removes the possibility of testing new or existing nuclear weapons going beyond the fractional-megaton range. Parties to the TTBT also undertook an obligation to continue negotiations toward a Comprehensive Test Ban Treaty (CTBT).”²³² Until 1990, neither the United States nor the Soviet Union ratified the TTBT, but beginning from 1976 the USSR and the U.S. announced its intention to observe the Treaty limit of 150 kilotons, pending ratification. After an agreement on additional verification provisions in 1990, it was finally ratified.</p>	<p>Consultation Article II 3. To promote the objectives and implementation of the provisions of this Treaty the Parties shall, as necessary, consult with each other, make inquiries and furnish information in response to such inquiries.</p> <hr/> <p>Constraint Article II 1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with the generally recognized principles of international law. 2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.</p>
<p>Peaceful Nuclear Explosions Treaty signed: 1976 into force: 1990</p>	<p>The Peaceful Nuclear Explosions Treaty was negotiated between the U.S. and the Soviet Union in addition to the Threshold Test Ban Treaty (TTBT). It “governs all nuclear explosions carried out at locations outside the weapons test sites specified under the Threshold Test Ban Treaty. The Parties agreed not to carry out any individual nuclear explosions having a yield exceeding 150 kilotons, and not to carry out any group explosion (consisting of a number of individual explosions) having an aggregate yield exceeding 1,500 kilotons.”²³³</p>	<p>Consultation Article V 1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall establish promptly a Joint Consultative Commission within the framework of which they will: (a) consult with each other, make inquiries and furnish information in response to such inquiries, to assure confidence in compliance with the obligations assumed; (b) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous; (c) consider questions involving unintended interference with the means for assuring compliance with the provisions of this Treaty; (d) consider changes in technology or other new circumstances which have a bearing on the provisions of this Treaty; [...]</p> <hr/> <p>Constraint Article IV 2. Each Party undertakes not to interfere with the national technical means of verification of the other Party [...].</p> <hr/> <p>Access/Verification Article IV 1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall: (a) use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law; and (b) provide to the other Party information and access to sites</p>

²³² “Threshold Test Ban Treaty (TTBT).” June 1998. The Nuclear Threat Initiative. 27 July 2010. <<http://www.nti.org/db/china/ttbtorg.htm>>.

²³³ “Threshold Test Ban Treaty.” Federation of American Scientists. 27 July 2010. <<http://www.fas.org/nuke/control/pnet/index.html>>.

		of explosions and furnish assistance in accordance with the provisions set forth in the Protocol to this Treaty.
<p>Comprehensive Test Ban Treaty opened for signature: 1996 into force: not yet</p>	<p>The CTBT is the successor to the Limited Test Ban Treaty (LTBT) that banned explosions in the atmosphere, in space, and under water; the U.S.–USSR bilateral Threshold Test Ban Treaty (TTBT); and the Peaceful Nuclear Explosions Treaty which limited the explosive yield of underground nuclear explosions. The CTBT goes beyond the LTBT in saying that no state that is party to the treaty should test nuclear weapons.</p> <p>As of January 2010, 182 nations had signed the CTBT and 151 had ratified it. Three nuclear weapon states, i.e. India, North Korea and Pakistan, have not signed the treaty. Among others, China, Iran, Israel and the U.S. have not ratified the Treaty, but signed it.</p>	<p>Transparency Article IV 16. The International Monitoring System shall comprise facilities for seismological monitoring, radionuclide monitoring including certified laboratories, hydroacoustic monitoring, infrasound monitoring, and respective means of communication, and shall be supported by the International Data Centre of the Technical Secretariat. 18. Each State Party shall have the right to participate in the international exchange of data and to have access to all data made available to the International Data Centre. Each State Party shall cooperate with the International Data Centre through its National Authority.</p> <hr/> <p>Consultation Article IV 29. Without prejudice to the right of any State Party to request an on-site inspection, States Parties should, whenever possible, first make every effort to clarify and resolve, among themselves or with or through the Organization, any matter which may cause concern about possible non-compliance with the basic obligations of this Treaty. 68. In order to: (a) Contribute to the timely resolution of any compliance concerns arising from possible misinterpretation of verification data relating to chemical explosions; and (b) Assist in the calibration of the stations that are part of the component networks of the International Monitoring System, each State Party undertakes to cooperate with the Organization and with other States Parties in implementing relevant measures as set out in Part III of the Protocol.</p> <p>Article VI 2. When a dispute arises between two or more States Parties, or between one or more States Parties and the Organization, relating to the application or interpretation of this Treaty, the parties concerned shall consult together with a view to the expeditious settlement of the dispute by negotiation or by other peaceful means of the parties' choice, including recourse to appropriate organs of this Treaty and, by mutual consent, referral to the International Court of Justice in conformity with the Statute of the Court. The parties involved shall keep the Executive Council informed of actions being taken.</p> <hr/> <p>Constraint Article I 1. Each State Party undertakes not to carry out any nuclear weapon test explosion or any other nuclear explosion, and to prohibit and prevent any such nuclear explosion at any place under its jurisdiction or control. 2. Each State Party undertakes, furthermore, to refrain from causing, encouraging, or in any way participating in the carrying out of any nuclear weapon test explosion or any other nuclear explosion. 6. The Organization shall conduct its verification activities provided for under this Treaty in the least intrusive manner possible consistent with the timely and efficient accomplishment of their objectives. It shall request only the information and data necessary to fulfil its responsibilities under this Treaty. [...]</p> <p>Article IV 2. Verification activities shall be based on objective information, shall be limited to the subject matter of this Treaty, and shall be carried out on the basis of full respect for the sovereignty of States Parties and in the least intrusive manner possible consistent with the effective and timely accomplishment of their objectives. Each State Party shall refrain from any abuse of the right of verification.</p>



		<p>Access Article IV 34. Each State Party has the right to request an on-site inspection in accordance with the provisions of this Article and Part II of the Protocol in the territory or in any other place under the jurisdiction or control of any State Party, or in any area beyond the jurisdiction or control of any State.</p>
--	--	--

A.3 Multilateral Non-Nuclear Non-Proliferation Efforts

Name	Summary	Proposed TCBMs
<p>Treaty on Conventional Armed Forces in Europe signed: 1990 into force: 1992</p>	<p>The Treaty was signed prior to the fall of the Soviet Union, by 22 NATO members and the Warsaw Pact, who agreed to limit non-nuclear forces in Europe. The 1992 "Tashkent Agreement" transferred the responsibility for the Soviet Union's Treaty-Limited items of Equipment (TLEs) among Azerbaijan, Armenia, Belarus, Kazakhstan, Moldova, Russia, Ukraine, and Georgia. The signatories were obliged to destruct/transfer specific major items of military equipment above designated national ceiling by November 1995. The reduction was also to serve as a confidence-building measure. Since the signing of the Treaty in 1990, Alliance total holdings of Treaty-Limited Equipment has been lowered from over 86,400 in 1990 to under 61,300 in 2007. The 1990 totals included those of then-sixteen members of the Alliance. The 2007 totals include the additional holdings of the six new members of the Alliance who are States Parties to the CFE Treaty (Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia). Accordingly, even though NATO has been enlarged, the overall holdings of Treaty-Limited Equipment of Allies have actually decreased by almost 30% and further reductions have already been announced.²³⁴</p> <p>To date, of the 30 States Parties, only Russia, Belarus, and Kazakhstan have ratified and deposited their instruments with the depositary state (the Netherlands). The Russian State Duma voted to ratify the Adapted CFE Treaty in July 2004, and Russia deposited its instrument of ratification on 06 December 2004. Ukraine has ratified but not deposited. It should be pointed out that both the Republic of Moldova and Georgia must also ratify and deposit for the</p>	<p>Transparency Article XIII 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, each State Party shall provide notifications and exchange information pertaining to its conventional armaments and equipment in accordance with the Protocol on Information Exchange. 3. Each State Party shall be responsible for its own information; receipt of such information and of notifications shall not imply validation or acceptance of the information provided.</p> <p>Article XV 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, a State Party shall have the right to use [...] national or multinational technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.</p> <p>Constraint Article XV 2. A State Party shall not interfere with national or multinational technical means of verification of another State Party operating in accordance with paragraph 1 of this Article. 3. A State Party shall not use concealment measures that impede verification of compliance with the provisions of this Treaty by national or multinational technical means of verification of another State Party operating in accordance with paragraph 1 of this Article. This obligation does not apply to cover or concealment practices associated with normal personnel training, maintenance or operations involving conventional armaments and equipment limited by the Treaty.</p> <p>Access Article XIV 1. For the purpose of ensuring verification of compliance with the provisions of this Treaty, each State Party shall have the right to conduct, and the obligation to accept, within the area of application, inspections in accordance with the provisions of the Protocol on Inspection. 2. The purpose of such inspections shall be: (A) to verify, on the basis of the information provided pursuant to the Protocol on Information Exchange, the compliance of States Parties with the numerical limitations set forth in Articles IV, V and VI;</p>

²³⁴ Questions and answers on CFE. North Atlantic Treaty Organization. 20 Jul. 2010. <http://www.nato.int/issues/arms_control/cfe_qa_factsheet.pdf>.

	<p>Adapted CFE Treaty to enter into force.</p> <p>The Adaptation Agreement revised the original document to take into account non-existence of the USSR and the Warsaw Pact and the entrance of the Czech Republic, Poland and Hungary to NATO. The CFE Treaty faces compliance issues. Moreover, in 2007, Russia suspended its participation on the CFE, partially due to insistence of other members for Russia to comply with the 1999 Istanbul Commitments and the proposed deployment of a U.S. ground-based missile defence system in the Czech Republic and Poland.</p>	
<p>Treaty on Open Skies signed: 1992 into force: 2002</p>	<p>Open Skies, originally proposed by President Eisenhower in 1955, was designed to serve as a confidence-building measure promoting openness and mutual understanding about military activities, as aerial overflights would both gather necessary intelligence and build confidence among the parties. The Soviet Union rejected the proposal due to espionage concerns, but President George H.W. Bush revived the proposal in May 1989. The treaty was signed in March 1992 by 22 European states, the U.S., and Canada (entering into force in January 2002 with the ratification by Russia and Belarus) and permitted unarmed aircraft to conduct flights over their territories. In 2008, states-parties celebrated the 500th overflight and since that time the number of flights flown has risen to over 650.²³⁵</p>	<p>Transparency Article III 1. Each State Party shall have the right to conduct observation flights in accordance with the provisions of this Treaty. 2. Each State Party shall be obliged to accept observation flights over its territory in accordance with the provisions of this Treaty.</p> <p>Article IV 11. Each State Party shall have the right to take part in the certification of sensors installed on observation aircraft [...]</p> <p>Article IX 4. Data collected by sensors during observation flights shall be made available to States Parties in accordance with the provisions of this Article and shall be used exclusively for the attainment of the purposes of this Treaty.</p> <p>Consultation Article X 1. In order to promote the objectives and facilitate the implementation of the provisions of this Treaty, the States Parties hereby establish an Open Skies Consultative Commission. 4. Within the framework of the Open Skies Consultative Commission the States Parties to this Treaty shall: A. consider questions relating to compliance with the provisions of this Treaty; B. seek to resolve ambiguities and differences of interpretation that may become apparent in the way this Treaty is implemented;</p> <p>Notification Article VI 5. The observing Party shall notify the observed Party of its intention to conduct an observation flight, no less than 72 hours prior to the estimated time of arrival of the observing Party at the point of entry of the observed Party</p> <p>Constraint Article IV 1. Except as otherwise provided for in paragraph 3 of this Article, observation aircraft shall be equipped with sensors only from amongst the following categories: [...] [and] 2. [...] subject to the following performance limits: [...]</p> <p>Article VIII</p>

²³⁵ "Open Skies Treaty." Arms Control Association. 26 July 2010. <<http://www.armscontrol.org/taxonomy/term/32>>.



		1. The observed Party shall have the right to prohibit an observation flight that is not in compliance with the provisions of this Treaty.
Seabed Arms Control Treaty signed: 1971 into force: 1972	The multilateral "Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof" bans the location of nuclear weapons and weapons of mass destruction in the seabed beyond a 12 miles coastal zone. In addition to the Soviet Union, the United States and the United Kingdom, 86 states adopted the treaty. ²³⁶ Like the Antarctic Treaty, the Outer Space Treaty, and the Latin American Nuclear-Free Zone, the goal of the Seabed Treaty was prevent international conflict and preserve the area free of nuclear weapons.	<p>Transparency/Access/Verification Article III</p> <p>3. If the State responsible for the activities giving rise to the reasonable doubts is not identifiable by observation of the object, structure, installation or other facility, the State Party having such doubts shall notify and make appropriate inquiries of States Parties in the region of the activities and of any other State Party. [...] If the identity of the State responsible for the activities cannot be ascertained through these inquiries, then further verification procedures, including inspection, may be undertaken by the inquiring State Party, which shall invite the participation of the Parties in the region of the activities [...].</p> <p>5. Verification pursuant to this article may be undertaken by any State Party using its own means, or with the full or partial assistance of any other State Party, or through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.</p> <p>Article I sets forth the principal obligation of the Treaty. It prohibits parties from emplacing nuclear weapons or weapons of mass destruction on the seabed and the ocean floor beyond a 12-mile coastal zone. Article II provides that the "seabed zone" is to be measured in accordance with the provisions of the 1958 Convention on the Territorial Sea and the Contiguous Zone. To make clear that none of the Treaty's provisions should be interpreted as supporting or prejudicing the positions of any party regarding law-of-the-sea issues, a broad disclaimer provision to this effect was included as Article IV.²³⁷</p>

A.4 Conventional Technology Control

Name	Summary	Proposed TCBMs
Missile Technology Control Regime established: 1987	The MTCR, established in 1987, provides a list of items to be controlled through its "MTCR Equipment, Software, and Technology Annex". The goal of the MTCR is to make foreign acquisition, or development, of delivery systems more difficult and expensive, especially if major producers restrict exports. The MTCR targets the proliferation of ballistic and cruise missiles, rockets, and unmanned air vehicles (UAV) capable of delivering weapons of mass destruction. ²³⁸ Specifically, the MTCR places restrictions on the export of ballistic missiles and related technologies that can achieve a range of 300 km or more and a weight of 500 kg in	<p>Transparency</p> <p>1. [...] The Guidelines are not designed to impede national space programs or international cooperation in such programs as long as such programs could not contribute to delivery systems for weapons of mass destruction. [...]</p> <p>3. In the evaluation of transfer applications for Annex items, the following factors will be taken into account: A. Concerns about the proliferation of weapons of mass destruction; B. The capabilities and objectives of the missile and space programs of the recipient state; [...]</p> <p>Information</p> <p>6. In furtherance of the effective operation of the Guidelines, the United States Government will, as necessary and appropriate, exchange relevant information with other governments applying the same Guidelines.</p> <p>Constraint</p> <p>1. [...] These Guidelines, including the attached Annex,</p>

²³⁶ "Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof." The State Department Website. 19 July 2010. <<http://www.state.gov/www/global/arms/treaties/seabed1.html>>.

²³⁷ "Seabed Arms Control Treaty." Arms Control Association. 26 July 2010. <<http://www.armscontrol.org/documents/seabed>>.

²³⁸ "The Missile Technology Control Regime" 05 Jul. 2010. <<http://mtrc.info/english/index.html>>.

	<p>payload or more which is considered to be nuclear capable.²³⁹ Over the past two decades, the MTCR has gradually shifted its attention from controlling only member-state exports to non-member missile threats. The MTCR Guidelines and Annex serve as a standard for responsible non-proliferation behaviour²⁴⁰ Although the MTCR recognises that “the technology used in a space launch vehicle is virtually identical to that used in a ballistic missile”,²⁴¹ it does not offer guidance concerning how to differentiate one from the other. It defines a space launcher as a missile for all practical purposes and bans the sale of its key technologies. The ban excludes “responsible” governments which commit to strict measures of end-use.²⁴² In North-east Asia, China and North Korea are the only countries not participating in this regime.</p>	<p>form the basis for controlling transfers to any destination beyond the Government’s jurisdiction or control of all delivery systems (other than manned aircraft) capable of delivering weapons of mass destruction, and of equipment and technology relevant to missiles whose performance in terms of payload and range exceeds stated parameters. [...]</p>
<p>Hague Code of Conduct Against Ballistic Missile Proliferation established: 2002</p>	<p>The International Code of Conduct Against Ballistic Missile Proliferation (ICOC), otherwise known as the Hague Code of Conduct, supplements the MTCR and was inaugurated on 5 November 2002. It is a set of norms seeking to address missile proliferation. It addresses issues connected with the demand aspect of proliferation via confidence-building measures (CBM), including pre-launch notification of ballistic missile tests. It states that space launch projects should not serve to disguise ballistic missile programmes. Like the MTCR, however, this agreement is not legally binding.</p> <p>The ICOC was endorsed by the UN General Assembly in 2004. As of May 20, 2009, 130 countries have subscribed to the HCOC, including the U.S. and Russia.</p>	<p>Transparency The Subscribing States: 2. Resolve to respect the following Principles: 2.6. Recognition that states should not be excluded from utilising the benefits of space for peaceful purposes, [...] 2.8. Recognition of the necessity of appropriate transparency measures on Ballistic Missile programmes and Space Launch Vehicle programmes in order to increase confidence and to promote non-proliferation of Ballistic Missiles and Ballistic Missile technology; 3. Resolve to implement the following General Measures: 3.4. To exercise the necessary vigilance in the consideration of assistance to Space Launch Vehicle programmes in any other country so as to prevent contributing to delivery systems for weapons of mass destruction, considering that such programmes may be used to conceal Ballistic Missile programmes;</p> <hr/> <p>Information 4.1.2. With respect to expendable Space Launch Vehicle programmes, and consistent with commercial and economic confidentiality principles, to:</p> <ul style="list-style-type: none"> • make an annual declaration providing an outline of their Space Launch Vehicle policies and land (test-) launch sites; • provide annual information on the number and generic class of Space Launch Vehicles launched during the preceding year, as declared in conformity with the pre-launch notification mechanism referred to hereunder, in tiret iii); <hr/> <p>Consultation 5. Organisational aspects Subscribing States determine to:</p>

²³⁹ Crail, Peter. “Iran Makes First Successful Space Launch.” Arms Control Today 39.2 (2009): 42.

²⁴⁰ McNerney, Patricia. “Principal Deputy Assistant Secretary McNerney Addresses Conference on Global Perspective of Proliferation Landscape.” (Remarks at the Naval Postgraduate School). Monterey: US FedNews: 10 June 2008.

²⁴¹ “MTCR Guidelines and the Equipment, Software and Technology Annex.” The Missile Technology Control Regime. 22 Apr. 2010. <<http://www.mtcr.info/english/guidelines.html>>.

²⁴² Rubin, Uzi. “America’s New Space Rivals: Iran, North Korea Swoop To Conquer,” The Washington Times, 20 Mar. 2009. A15.



		<p>5.1. Hold regular meetings [...] 5.2. Take all decisions, both substantive and procedural, by a consensus of the Subscribing States present; 5.3. Use these meetings to define, review and further develop the workings of the Code [...].</p> <hr/> <p>Notification 4.1.3. With respect to their Ballistic Missile and Space Launch Vehicle programmes to:</p> <ul style="list-style-type: none"> • exchange pre-launch notifications on their Ballistic Missile and Space Launch Vehicle launches and test flights. These notifications should include such information as the generic class of the Ballistic Missile or Space Launch Vehicle, the planned launch notification window, the launch area and the planned direction; [...] <hr/> <p>Constraint The Subscribing States: 2. Resolve to respect the following Principles: 2.6. [...] [that] they must not contribute to the proliferation of Ballistic Missiles capable of delivering weapons of mass destruction; 2.7. Recognition that Space Launch Vehicle programmes should not be used to conceal Ballistic Missile programmes;</p> <hr/> <p>Access 4.1.2. With respect to expendable Space Launch Vehicle programmes, and consistent with commercial and economic confidentiality principles, to:</p> <ul style="list-style-type: none"> • consider, on a voluntary basis (including on the degree of access permitted), inviting international observers to their land (test-) launch sites;
<p>The Wassenaar Arrangement established: 1996</p>	<p>The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies replaced in 1996 the Coordinating Committee for Multilateral Export Controls (known as CoCom), the Cold War organisation controlling sensitive exports of technologies to communist states.</p> <p>As of December 2009, 40 members are participating in the arrangement designed, among other, to promote transparency and greater responsibility in transfer of conventional arms and dual use goods and technologies. The effectiveness is challenged by consensus nature of decision-making, limited list of controlled goods, and not so rigorous control regime where each national government regulates its own exports.</p>	<p>Transparency Initial Elements of 1996: II Scope 2. [...] Participating States will exchange, on a voluntary basis, information that will enhance transparency, will lead to discussions among all Participating States on arms transfers, as well as on sensitive dual-use goods and technologies, and will assist in developing common understandings of the risks associated with the transfer of these items. On the basis of this information they will assess the scope for co-ordinating national control policies to combat these risks. The information to be exchanged will include any matters which individual Participating States wish to bring to the attention of others, including, for those wishing to do so, notifications which go beyond those agreed upon. 4. In accordance with the provisions of this Arrangement, Participating States agree to notify transfers and denials. [...]</p> <hr/> <p>Constraint Initial Elements of 1996, II Scope 3. The decision to transfer or deny transfer of any item will be the sole responsibility of each Participating State. All measures undertaken with respect to the Arrangement will be in accordance with national legislation and policies and will be implemented on the basis of national discretion</p> <p>IX. Confidentiality Information exchanged will remain confidential and be treated as privileged diplomatic communications. This confidentiality will extend to any use made of the information and any discussion among Participating States.</p>

A.5 Weapons-Elimination Efforts

Name	Summary	Proposed TCBMs
<p>Chemical Weapons Convention signed: 1993 into force 1997</p>	<p>The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (CWC) aims at eliminating an entire category of weapons of mass destruction by prohibiting the development, production, acquisition, stockpiling, retention, transfer or use of chemical weapons by States Parties. States Parties, in turn, must take all necessary steps to enforce that prohibition in respect of persons (natural or legal) within their jurisdiction. The States Parties have agreed to destroy any stockpiles of chemical weapons they may hold and any facilities which produced them, as well as any chemical weapons they abandoned on the territory of other States Parties in the past. States Parties have also agreed to create a verification regime for certain toxic chemicals and their precursors (listed in Schedules 1, 2 and 3 in the Annex on Chemicals to the CWC). The CWC incorporated so-called 'challenge inspection', whereby any State Party in doubt about another State Party's compliance can request the Director-General to send an inspection team. Under the CWC's 'challenge inspection' procedure, States Parties have committed themselves to the principle of 'any time, anywhere' inspections with no right of refusal. The routine arrangements are limited by the declarations required of State Parties and these declarations are completely dependent on national monitoring and data collection.²⁴³ As of May 2009, 188 states are members of the CWC.²⁴⁴</p>	<p>Transparency Article VII 1. Each State Party shall, in accordance with its constitutional processes, adopt the necessary measures to implement its obligations under this Convention. In particular, it shall: (a) Prohibit natural and legal persons anywhere on its territory or in any other place under its jurisdiction as recognized by international law from undertaking any activity prohibited to a State Party under this Convention, including enacting penal legislation with respect to such activity; (b) Not permit in any place under its control any activity prohibited to a State Party under this Convention; [...]</p> <hr/> <p>Information Article III 1. Each State Party shall submit to the Organization, not later than 30 days after this Convention enters into force for it, the following declarations, in which it shall: (a) With respect to chemical weapons: (I) Declare whether it owns or possesses any chemical weapons, or whether there are any chemical weapons located in any place under its jurisdiction or control; [...]</p> <hr/> <p>Consultation 1. States Parties shall consult and cooperate, directly among themselves, or through the Organization or other appropriate international procedures, including procedures within the framework of the United Nations and in accordance with its Charter, on any matter which may be raised relating to the object and purpose, or the implementation of the provisions, of this Convention.</p> <hr/> <p>Constraint Article I 1. Each State Party to this Convention undertakes never under any circumstances: (a) To develop, produce, otherwise acquire, stockpile or retain chemical weapons, or transfer, directly or indirectly, chemical weapons to anyone; (b) To use chemical weapons; (c) To engage in any military preparations to use chemical weapons;</p> <p>Annex, Part II 13. Without prejudice to their privileges and immunities the members of the inspection team shall be obliged to respect the laws and regulations of the inspected State Party or Host State and, to the extent that is consistent with the inspection mandate, shall be obliged not to interfere in the internal affairs of that State. If the inspected State Party or Host State Party considers that there has been an abuse of privileges and immunities specified in this Annex, consultations shall be held between the State Party and the Director-General to determine whether such an abuse has occurred and, if so determined, to prevent a repetition of such an abuse.</p> <hr/> <p>Access 8. Each State Party has the right to request an on-site challenge inspection of any facility or location in the</p>

²⁴³ Bothe, Michael, Natalino Ronzitti, and Allan Rosas. "The New Chemical Weapons Convention – Implementation and Prospects." The Hague, NL: Kluwer Law International, 1998. 220.

²⁴⁴ "Status of Participation in the Chemical Weapons Convention as at 21 May 2009." 27 May 2009. Organisation for the Prohibition of Chemical Weapons. 29 July 2010. <http://www.opcw.org/file/status_of_participation_in_the_chemical_weapons_convention_as_at_21_may_2009/>.



		territory or in any other place under the jurisdiction or control of any other State Party for the sole purpose of clarifying and resolving any questions concerning possible non-compliance with the provisions of this Convention, and to have this inspection conducted anywhere without delay by an inspection team designated by the Director-General and in accordance with the Verification Annex.
<p>Biological Weapons Convention signed: 1972 into force: 1975</p>	<p>The 1972 BWC bans the development, stockpiling, transfer, and use of biological weapons (BW) worldwide. It does not, however, include formal enforcement mechanism to ensure compliance by its member states. BW convention is more difficult to monitor than international treaties controlling nuclear and chemical arms, as some materials and equipment are of dual-use, suitable for BW programmes as well as commercial activities making complete verification impossible. Transparency measures, such as declarations and inspections help better understand treaty-relevant facilities and activities, an effort to draft a BWC Protocol was proposed by the "Ad Hoc Group" established in 1994 at a special conference the purpose of which was to strengthen the BWC to negotiate a compliance regime for the BWC. This protocol, however, has not been approved.</p> <p>Overall, the BWC Protocol would not be able to determine the level of violation similar to nuclear and chemical arms violations. However, it was designed as a platform for greater transparency concerning dual-capable facilities and activities.</p>	<p>Transparency Article IV Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition, or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.</p> <hr/> <p>Consultation Article V The States Parties to this Convention undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and Cooperation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.</p> <hr/> <p>Constraint Article I Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain: (1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes; (2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.</p>
<p>Ottawa Treaty/Mine Ban Treaty signed: 1997 into force: 1999</p>	<p>The Ottawa Treaty or Mine Ban Treaty was signed by more than 150 states and bans completely the use, stockpiling and development of anti-personnel land-mines. It does not cover mixed mines or for example anti-tank mines. Every participating country is to destroy all anti-personnel mines in their possession within four years and make its area mine-free within ten years. As of June 1, 2008, 156 states</p>	<p>Transparency Article 9 Each State Party shall take all appropriate legal, administrative and other measures, including the imposition of penal sanctions, to prevent and suppress any activity prohibited to a State Party under this Convention undertaken by persons or on territory under its jurisdiction or control.</p> <p>"Each state-party is to provide the United Nations with a comprehensive report on the numbers, types, and locations of all APLs under its control as well as the status of all programs for destroying APLs. An initial report is required 180 days after the treaty becomes legally binding for each state-party, and thereafter reports are expected annually by April 30."²⁴⁶</p>

²⁴⁵ "The Ottawa Convention at a Glance." June 2008. Arms Control Association. 27 July 2010. <<http://www.armscontrol.org/factsheets/ottawa>>.

²⁴⁶ "The Ottawa Convention at a Glance." June 2008. Arms Control Association. 27 July 2010. <<http://www.armscontrol.org/factsheets/ottawa>>.

	<p>had become party to the accord, and another two countries had signed but not ratified it.²⁴⁵ Among countries that have not yet signed the treaty are China, Russia, the United States, as well as India, Israel, North and South Korea.</p>	<p>Information Article 7 1. Each State Party shall report to the Secretary-General of the United Nations as soon as practicable, and in any event not later than 180 days after the entry into force of this Convention for that State Party on: a) The national implementation measures referred to in Article 9; b) The total of all stockpiled anti-personnel mines [...] i) The measures taken to provide an immediate and effective warning to the population in relation to all areas identified under paragraph 2 of Article 5.</p> <hr/> <p>Consultation Article 8 1. The States Parties agree to consult and cooperate with each other regarding the implementation of the provisions of this Convention, and to work together in a spirit of cooperation to facilitate compliance by States Parties with their obligations under this Convention. 2. If one or more States Parties wish to clarify and seek to resolve questions relating to compliance with the provisions of this Convention by another State Party, it may submit, through the Secretary-General of the United Nations, a Request for Clarification of that matter to that State Party. Such a request shall be accompanied by all appropriate information. Each State Party shall refrain from unfounded Requests for Clarification, care being taken to avoid abuse. A State Party that receives a Request for Clarification shall provide, through the Secretary-General of the United Nations, within 28 days to the requesting State Party all information which would assist in clarifying this matter. 8. If further clarification is required, the Meeting of the States Parties or the Special Meeting of the States Parties shall authorize a fact-finding mission and decide on its mandate by a majority of States Parties present and voting.</p> <p>Article 10 1. The States Parties shall consult and cooperate with each other to settle any dispute That may arise with regard to the application or the interpretation of this Convention. Each State Party may bring any such dispute before the Meeting of the States Parties.</p>
--	---	---



List of Acronyms

Acronym	Explanation
AAIA	American Institute of Aeronautics and Astronautics
ABM	Anti-Ballistic Missile
APL	Anti-Personnel Mines
ASAT	Anti-Satellite Weapon
ASI	Agenzia Spaziale Italiana, the Italian Space Agency
BBC	British Broadcasting Corporation
BNSC	British National Space Centre
BWC	Biological Weapons Convention
CBM	Confidence-Building Measure
CCSDS	Consultative Committee for Space data System
CD	Conference on Disarmament
CFE	Convention on Armed Forces in Europe – or – Commercial and Foreign Entities
CFSP	Common Foreign and Security Policy
CNES	Centre National d'Études Spatiales (the French Space Agency)
COPUOS	Committee on the Peaceful Uses of Outer Space
CSBM	Confidence and Security Building Measure
CTBT	Comprehensive Test-Ban Treaty
CWC	Chemical Weapons Convention
DLR	Deutsches Zentrum für Luft- und Raumfahrt, the German Aerospace Center
DW	Deutsche Welle, Germany's public international broadcasting service
EC	European Commission
EMP	Electromagnetic Pulse
ESA	European Space Agency
EU	European Union
FMCT	Fissile Material Cut-off Treaty
GEO	Geostationary Earth Orbit
GEOSS	Global Earth Observation System of Systems
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTRI	Global Threat Reduction Initiative
IAASS	International Association for the Advancement of Space Safety
IADC	Inter-Agency Space Debris Coordination Committee
IAEA	International Atomic Energy Agency

Acronym	Explanation
ICA	International Civil Aviation Organization
ICBM	Intercontinental Ballistic Missile
ICOC	International Code of Conduct Against Ballistic Missile Proliferation
ID	Identification
INF	Intermediate-Range Nuclear Forces Treaty
IRBM	Intermediate-Range Ballistic Missile
ISOG	International Satellites Operations Group
ISS	International Space Station
ITU	International Telecommunication Union
KE ASAT	Kinetic-Energy Anti-Satellite Weapon
LEO	Low Earth Orbit
LTBT	Limited Test-Ban Treaty (also known as Partial Test Ban Treaty,PTBT)
MAD	Mutually Assured Destruction
MEO	Medium Earth Orbit
MIRV	Multiple Independently Targetable Reentry Vehicle
MPC&A	Material Protection, Control and Accounting
MS	Member State
MTCR	Missile Technology Control Regime
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NEO	Near-Earth object
NNWS	Non-Nuclear-Weapon State
NPT	Nuclear Non-Proliferation Treaty
NSG	Nuclear Suppliers Group
NTM	National Technical Means
NW	Nuclear Weapon
NWFZ	Nuclear-Weapon-Free Zone
NWS	Nuclear-Weapon State
OOSA	United Nations Office for Outer Space Affairs
OSCE	The Organization for Security and Co-operation in Europe
OST	Outer Space Treaty
PAROS	Prevention of an Arms Race in Outer Space, discussed in the Conference on Disarmament
PPWT	Draft Treaty on the "Prevention of Placement of Weapons in Outer Space"
PRC	People's Republic of China
PSI	Proliferation Security Initiative
PTBT	Partial Test Ban Treaty
RF	Radiofrequency
RR	Radio Regulations
SALT	Strategic Arms Limitation Talks



Acronym	Explanation
SES	a satellite company, originally "Société Européenne des Satellites"
SLBM	Submarine-Launched Ballistic Missile
SLV	Space Launch Vehicle
SORT	Strategic Offensive Reductions Treaty (known as the Moscow Treaty)
SSA	Space Situational Awareness
SSN	United States Air Force Space Surveillance Network
START	Strategic Arms Reduction Treaty
STM	Space Traffic Management
STSC	Scientific & Technical Subcommittee of United Nations COPUOS
SUIRG	Satellite Users Interference Reduction Group
TCBM	Transparency and Confidence-Building Measure
TLE	Treaty-Limited Equipment
TTBT	Threshold Test Ban Treaty
U.S.	United States of America
UARS	Upper Atmosphere Research Satellite
UAV	Unmanned Aerial Vehicle
UK	United Kingdom of Great Britain and Northern Ireland
UN	United Nations
UNGA	United Nations General Assembly
UNIDIR	United Nations Institute for Disarmament Research
UNSCOM	UN Special Commission on Iraq
UNSCR	United Nations Security Council Resolution
USSR	Union of Soviet Socialist Republics
WA	Wassenaar Arrangement
WBU	World Broadcasting Unions
WMD	Weapon(s) of Mass Destruction

Acknowledgements

The author would like to express sincere appreciation to the distinguished experts that kindly provided their valuable insights and comments during the preparation of this study, including Lt. Col. Brandon L. Hart, USAF, Chief of Cyber and Space Law, U.S. Strategic Command (USSTRATCOM), Kenneth Hodgkins, Director for the Office of Space and Advanced Technology in the Bureau of Oceans, Environment and Science at the U.S. Department of State, Amb. Rüdiger Lüdeking, Permanent Representative of the Federal Republic of Germany to the Office of the United Nations and to other International Organizations, Vienna, and Richard L. Williamson, Professor of Law at the University of Miami. Also to be recognised are those that generously dedicated their executive time to

reviewing sections of the study and who provided critical feedback to enhance the study's accuracy and scope, especially Dr. Peter L. Hays of the Eisenhower Center for Space and Defense Studies, Prof. John M. Logsdon of the George Washington University's Space Policy Institute, and Jean-Francois Mayence of the Belgian Federal Office for Science Policy.

Finally, the author wishes to express special appreciation to Dr. Kai-Uwe Schrogl, ESPI Director, for his expert guidance during the drafting process, as well as to ESPI Research Interns Andreas Baur, Marcus Hornung and Maarten Adriaensen whose contributions proved of substantial value to this undertaking.

About the Author

Jana Robinson has been Resident Fellow at the European Space Policy Institute (ESPI) since December 2009. Prior to joining ESPI, she served as Development Director for the Prague Security Studies Institute (PSSI) from 2005–2009, a leading, Prague-based, non-profit public policy organization focused on security policy and studies. She was likewise responsible for the corporate establishment of PSSI Washington, a non-profit organization in Washington D.C., closely affiliated with PSSI Prague. Previously, she held positions consistent with her academic background in Asian Studies that made use of her Mandarin language skills. Jana Robinson is currently

pursuing her PhD at Charles University focusing on space security. She holds an MA in Asian Studies from George Washington University's Elliott School of International Affairs, in Washington DC specializing in Asia-Pacific security issues and space policy, and an MA in Asian Studies from Palacky University, Olomouc, Czech Republic. She received scholarships to attend the International Space University (ISU) 2009 Space Studies Program (SSP09), 2008 Summer Mandarin Training Course at the Mandarin Training Center of the National Taiwan Normal University in Taipei, and Shanghai University in 1999-2000.

Mission Statement of ESPI

The mission of the European Space Policy Institute (ESPI) is to provide decision-makers with an independent view and analysis on mid- to long-term issues relevant to the use of space.

Through its activities, ESPI contributes to facilitate the decision-making process, increases awareness of space technologies and applications with the user communities, opinion leaders and the public at large, and supports researchers and students in their space-related work.

To fulfil these objectives, the Institute supports a network of experts and centres of excellence working with ESPI in-house analysts.

www.espi.or.at