European Space Policy Institute

Prospects for Transparency and Confidence-Building Measures in Space

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Foreword

There are few subjects that will gain more attention in the coming years than transparency and confidence-building measures (TCBMs) to enhance and sustain space security. This is largely a function of the growing stature and visibility of space itself as integral part of the day to day lives of the world's people. It is for this overarching reason that the European Space Policy Institute (ESPI) and the University of Nebraska, Lincoln (UNL) College of Law's Space and Telecom Law Program partnered to configure a two-day conference on 6–7 May 2010 entitled "Space Security and Space Tourism: Challenges to, and Transatlantic Perspectives on, Governance". The first day of this event, which took place at UNL, was dedicated to "Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security" the proceedings and findings of which are embodied in this Report. A number of distinguished political, military and private sector experts and scholars, including a keynote address by U.S. Air Force Gen. Kevin P. Chilton, Commander of U.S. Strategic Command (US STRATCOM), participated in this event. Several of these experts kindly agreed to provide written contributions to this Report.

The sponsors of this conference remain committed to continuing their efforts to broaden the understanding of this crucial subject both within the global space community as well as the larger policy-making communities of key space-faring nations and those aspiring to this status.

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1. The Status and Future Evolution of Transparency and Confidence-Building Measures

by Jana Robinson

1.1 Present Status of TCBMs

Geopolitically, the threat environment confronting European and other countries in the 21st century is markedly different from that of the Cold War period. The world entered this new century witnessing: the unprecedented terrorist attack on the U.S. on 11 September 2001, a U.S. assault on al-Qaeda and Taliban forces in Afghanistan, a second Iraq war, an Israeli military incursion into Lebanon, the continuing Palestinian-Israeli conflict in Gaza, a Russian invasion of Georgia in August 2008, on-going genocide in Sudan, nuclear crises in Iran and North Korea, and the list goes on. In space, the growing amount of orbital debris, a congested geostationary orbit, finite availability of the radiofrequency spectrum, the increasing number of countries operating satellites and acquiring launching capabilities, the growing dependence on space services by civilians as well as militaries worldwide, and inadequate contingency planning for "incidents", disruptive counterspace activities, or even the denial of access to space-based assets and other space security issues, challenge the global space-faring community and urgently require attention. The nature of these space-related developments reveals much about the evolution of the dangers to the stability and safety of space and earth-based security issues that can implicate it.

In short, the traditional threat scenarios that dominated the 20th century have been, to a surprising extent, supplanted by new ones, including those involving outer space. Asymmetric war-fighting strategies, together with economic and financial globalisation, for example, have given rise to heightened proliferation concerns involving both state and non-state actors. The international debate about the role of intelligence and preemption, versus Cold-War deterrence and containment, has become more pronounced. Meanwhile, prediction, prevention, and crisis management are considerably more difficult to orchestrate in the information age.

States that possess an advanced understanding and commitment to international law are often the most credible players with respect to creative and persuasive diplomacy as well as conflict resolution. The post-1945 dissemination of nuclear weapons, along with the U.S.-Soviet doctrine of mutually-assured destruction (MAD) and the advent of more sophisticated ballistic missile delivery systems have done much to shape today's "balance of power". The 9/11 attack, the Madrid bombings in 2004, and London metro bombings in 2005, are emblematic of the fact that even developed, democratic countries are exposed to these new asymmetric warfare tactics. It is doubtful, therefore, that countries will substantially reduce, much less terminate, their investments in military research and development activities. Such investments are often not only viewed as a crucial dimension of a country's security, but also national pride and sense of autonomy.

In this uncertain, complex security environment, Transparency and Confidence-Building Measures (TCBMs) stand out as increasingly important policy tools in preserving global security, including in space. Europe generally favours inclusive, preemptive space diplomacy, for example by providing emerging competitors with concrete incentives to help safeguard access to, and use of, space. The EU Draft Code of Conduct for Outer Space Activities (below referred to as the EU Code of Conduct), issued in December 2008, represents a non-treaty-based effort to advance space security and raises a number of action items for consideration. The EU Code of Conduct side-steps the daunting task of defining space weapons or advocating a certain brand of arms control that prohibits their placement in space. It rather focuses on how to use outer space in a peaceful manner that immensely benefits mankind. TCBMs in outer space could serve as the connective tissue in helping define and implement actions called for in the EU Code of Conduct document.

Although several other proposals along these lines have been tabled in the UN and elsewhere, they have, thus far, become bogged down or dismissed altogether as they focused on such issues as prohibiting space weapons or were linked to arms control agreements. One of the most interesting initiatives, however, is embodied in the "best practices guidelines" prepared within the COPUOS. There is no question that space activities now require enhanced governance and discipline, the design of "best practices". As this mechanism is, in some cases, less politically sensitive than seeking support for specific TCBMs, it may prove a useful vehicle for implementation of TCBM-look-alikes.

1.2 Summary of TCBM Conference Proceedings

To help address and illuminate some of the issues cited above, an international conference on space security and space tourism was convened by the European Space Policy Institute (ESPI) together with the University of Nebraska (UNL) College of Law's Space and Telecom Law Program. The first day of the conference, entitled "Transparency and Confidence-Building Measures: Alternative Vehicles to Advance Space Security", was dedicated to the challenges associated with successfully adopting transparency and confidence-building measures in space. Invited speakers and panelists included prominent government officials, ESA representatives, and distinguished academics from Europe and the U.S.

The discussions focused on potentially relevant "terrestrial" TCBMs for space as well as different mechanisms for the review and implementation of proposed space security management regimes. It also sought to highlight the advantages and shortcomings of existing proposals on these subjects. Included in the report are several recommendations concerning the most viable ways of establishing the kind of transparency, incentives, disincentives and compliance and enforcement measures necessary to deter actions by space-faring and other nations and non-state actors that could impede or deny unfettered access to, and use of, space. A more detailed summary of the discussion is provided below.

TCBM Discussions: Terrestrial and Space

The four panels generally focused on challenges associated with adoption of transparency and confidence-building measures (TCBMs) in space and the rationale for such measures. First, panelists discussed how terrestrial TCBMs can serve as a guide to understanding better the politically possible in space, including useful precedents. Examples were drawn, among others, from the Partial Test Ban Treaty (PTBP), Nuclear Non-Proliferation Treaty (NPT), International Atomic Energy Agency (IAEA), Chemical Weapons Convention (CWC), Biological Weapons Convention (BWC), Strategic Arms Reduction Treaty (START), Conventional Forces of Europe (CFE) Treaty, the Open Skies Treaty, and The International Code of Conduct Against Ballistic Missile Proliferation (ICOC).

A central theme of the discussions was that in the governance of space, countries should be obliged to: agree upon norms acceptable for the largest number of space-faring nations; clarify the concrete meaning of such norms by creating, for example, a list of illicit activities; and establish means of verification and enforcement. In addition, there appeared to be a general consensus that the right mix of political will and levels of verification are key to achieving a climate of confidence in space.

The final two panels addressed space-relevant measures, proposed or already in place, to identify the most effective ways to strengthen space security. The formal government-led proposals analyzed included the Draft Treaty on "Prevention of Placement of Weapons in Outer Space" (PPWT), Canada's Working Paper on "Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security" introduced in the Conference on Disarmament (CD), and the EU Draft Code of Conduct. Among the "bottom-up" proposals highlighted were the IADC Space Debris Mitigation Guidelines (IADC Guidelines), the Stimson Center Code of Conduct, the concept of Space Traffic Management (STM) and efforts to advance "long-term sustainability of outer space activities".

To enrich the report of the conference proceedings, a number of distinguished experts in the arms control, nonproliferation, and space security fields provided written contributions that appear in section two below. They included: Erwin Duhamel of ESA, Lt. Col. Brandon Hart of USSTRATCOM, Joshua Hartman of the Center for Strategic and International Studies, Prof. Bhupendra Jasani of King's College London, Jean-François Mayence of the Belgian Federal Office for Science Policy, Dr. Peter L. Hays of the Eisenhower Center for Space and Defense Studies, and Prof. Richard Williamson of the University of Miami.

Terrestrial TCBMs

The terrestrial TCBM examples included both bans prior to "incidents" occurring (e.g. the Antarctica Treaty), and restrictions on already existing military capabilities (e.g. the INF Treaty, etc.). It was pointed out that bilateral agreements are easier to achieve, but multilateral ones may prove more effective as they impose greater responsibility and peer pressure. The NPT Treaty was cited as the most comprehensive treaty to date due to its role in addressing priority security concerns, but also due to the willingness of major countries to comply.

Sharing of information was emphasised as an important TCBM as state to state relations rely in a significant way on knowing each other's economic and military intentions and capabilities. The proposed International Satellite Monitoring Agency (ISMA) was referenced in this context. The use of satellites for verification purposes was also a topic, including the fact that the IAEA established its own satellite data interpretation capabilities, representing the first use of satellite data by the UN.

The advantages and limitations of unilateral, bilateral, and multilateral TCBMs were likewise discussed. It was generally agreed that although unilateral declarations can be useful, unilateral actions are more likely to be taken seriously by the space-faring community. Overall, multilateral TCBMs were considered the most valuable, although harder to achieve. In this connection, the similarity and overlap of "best practices guidelines" and space TCBMs was noted.

Space TCBMs

When reviewing the existing norms in place, a number of panellists emphasised the fundamental role of the Outer Space Treaty (OST) and lack of adherence to existing obligations outlined there. For example, it was pointed out that the consultation mechanism of the OST's Article 9 has never been implemented. At the same time, supportive mechanisms to advance compliance with space-related obligations need to be strengthened via non-binding means. Options include the EU Draft Code of Conduct for Outer Space Activities and the UN Best Practices Guidelines to ensure long-term sustainability and predictability with regard to outer space activities.

Concerning verification, the asymmetric distribution of space capabilities, including SSA, needs to be taken into account. Moreover, legal and practical issues such as the definition of a "launching state" as well as satellite registration practices need to be undertaken. It was agreed that further engagement of space-faring and other nations is a prerequisite for meaningful progress on TCBMs and other elements of space security.

Overall, there is a fairly distinguished history of developing various cooperative mechanisms regarding space security, including through formal (governmental) as well as informal channels (e.g. detailed technical exchanges, etc.). It was observed, however, that to achieve more meaningful and comprehensive TCBMs, among the following steps need to be taken: generate the political will on the part of states to identify where a common interest in such measures exist and agree to specific provisions; establish favourable conditions for agreement on strengthened TCBMs; lessen the dependency on the terrestrial nuclear arms control dialogue; and diversify the space debate away from undue attention to an arms race in space.

1.3 Outlook

As stated in the Introduction, TCBMs will likely prove a permanent part of the space policy landscape for the foreseeable future. The growing risks associated with the pivotal role played by space-based assets make this element of space security an imperative. Indeed, the debate in the future will likely centre on how to strengthen and market TCBMs, particularly with regard to compliance, verification, and enforcement. Various penalties attendant to different types of space-related abuses have yet to be adequately configured at a time when, for example, counterspace capabilities are already under development.

Contingency measures and other dimensions of space crisis management are also lagging and need to be accorded greater priority by policy-makers worldwide. Non-governmental organisations, academic institutions, the media and various public policy groups can all contribute to accelerating attention to these remaining deficiencies. In this connection, conferences and gatherings like this one are indispensable to the task of constructing the intellectual, practical and technical basis for sound new policies that anticipate the future downside risks associated with a more complex, congested and competitive space environment.

Finally, the Transatlantic partnership should serve as the global engine for enhanced space security. In this connection, both sides need to redouble their efforts to provide true leadership on the most pressing of these issues. This ongoing challenge argues for a more institutionalised relationship between NATO and Europe in the near term in which the U.S. can offer unique inputs.

Regrettably, the proverbial genie is out of the bottle on counterspace capabilities (e.g. the development of co-orbital ASATs, etc.) that cannot be rebottled, only contained. Absent an agreed, integrated space security matrix configured together by Europe and the U.S., civilian and commercial space activities will almost surely be hobbled (e.g. higher insurance costs, etc.) and more vulnerable. The temptation to exploit this target-rich asymmetric warfare environment may prove to be nearly impossible for some countries to resist over time, particularly ambitious space-faring nations in which the military is the dominant player. Accordingly, the legacy of space TCBMs, and coordinated space security measures more broadly should be that they were created, negotiated and institutionalised in peace time and prior to space having been openly contested.

2. Contributions to TCBM Conference

2.1 ESA Assessment of Transparency and Confidence-Building Measures
by Erwin Duhamel

2.1.1 Introduction

An initiative for a *Code of Conduct for outer space activities* was proposed by Portugal, then acting as the Presidency of the EU, on 18 September 2007. The proposal was discussed throughout 2008 by EU Member States in the EU's Council Working Group on Global Disarmament and Arms Control (CODUN). On 8-9 December 2008, the EU's General Affairs and External Relations Council adopted Conclusions regarding the draft Code of Conduct.

This initiative is the European contribution to two issues that have been greatly debated in the UN, and more specifically in the Conference on Disarmament (CD):

1. International outer space *transparency and confidence-building measures* (TCBMs) in the interest of maintaining international peace and security, preventing military incidents in space and promoting international cooperation;
2. *Prevention of an arms race in outer space* (PAROS), alternatively known as prevention of the placement of weapons in outer space (PPWT).

This initiative has relevance in a context of growing concerns around the world regarding the vulnerability of space assets, anti-satellite tests (ASAT), the development of space weapons, as well as space debris mitigation concerns. The EU's leadership in this matter can be seen in the context of the European Space Policy (ESP) and a growing political dimension of space in Europe.

It should be emphasized that this analysis remains *preliminary* insofar as it assesses a *draft* text, still under active negotiation. Actual effects and potential resulting actions should be specifically considered only once a final draft is adopted.

2.1.2 Scope and Applicability

As a preliminary consideration it should be noted that:

- The Code is intended to be an *international* Code of Conduct, which is being proposed as an EU diplomatic initiative. Therefore all world space faring nations and countries owning in-orbit assets may abide to its terms.
- The Code is binding upon a State only if it subscribes to it, on a *voluntary* basis, except for the norms it codifies and which are thus potentially already of a customary legal nature (and thus binding even on non-Signatory States).
- The Code is *open to States only*, whose provisions remain however applicable to a State's activities within the framework of intergovernmental organisations. ESA as an international organisation cannot be a signatory of the text as it stands now. In effect, this means that although ESA will not be in a position to officially endorse the Code, *its terms could de facto be applicable to its activities* depending on the number of its Member States endorsing the Code. This poses a parallel issue throughout the Code when there is mention of "national" policies, strategies, assets etc. insofar as ESA operates spacecraft on behalf of its Member States, while also excluding European assets from the scope of the Code To remedy this situation, it could, however, be suggested to include a mechanism to formalise the participation of international intergovernmental organisations, comparable to what has been done in the last four UN Treaties on Outer Space, where the fact that international organisations may be subject to obligations under a Treaty although they may not become parties has been resolved by a special clause rendering the Treaty applicable to international organisations if two conditions are met:

    1. if the majority of the State Members of that international organisation are Contracting Parties to the respective convention or agreement and the Outer Space Treaty and

2. if the international organisation declares to accept the resulting rights and obligations.

It remains unclear whether an international organisation itself – and with it incidentally also those of its Member States, that are not themselves Subscribing States to the Code of Conduct, can be bound by obligations imposed by the Code of Conduct.

The Code is meant to address both space security (military) and space safety,[1] i.e. both civil and military activities. While the aspect of safety has been necessarily included to recognise that the issues related to space debris and traffic management are common to both fields. Nevertheless, the Code may bring important practical benefits in the area of space safety and have resonance on civil space operations as conducted by ESA or its Member States.

2.1.3 General Policy and Legal Assessment

First, it ought to be recalled that regulatory issues, including defence/space issues, are an integral part of ESP implementation and have significant political relevance to ESA and its Member States. Legally, the relevance of its scope is however somewhat minimized by the fact that numerous instruments already construct the space law architecture.

Yet, the purpose of this Code is neither to duplicate nor compete with other similar initiatives, nor to oppose them but rather seeks to complement and contribute to those initiatives, *inter alia* by insisting on the importance to take all measures in order to prevent space from becoming an area of conflict.

Some key points of the Code are:

- It recalls the "*freedom of access*" principle, already enshrined in other space law instruments.
- More importantly, the "inherent *right to self-defence*" is explicitly emphasized and echoes Article 51 of the UN Charter, a basic principle of the international collective security framework and rare exception to the prohibition of the use of force[2].
- It further recalls the principle of *international cooperative, good faith governance* of outer space activities to prevent all kinds of harmful interference with outer space activities of others.
- More significant from a security perspective, the provisions recall on one hand the well-established *principle that military support systems in space* (e.g. GPS, telecommunications, etc.) *are not contrary to the principle to use outer space for exclusively peaceful purposes (Article III Outer Space Treaty)*, and on the other hand that *space should not become weaponized* in the wider sense (i.e. preventing deployment of ground-to-space, space-to-space, and space-to-ground weapons).
- One of the tasks provided for in the Code will be the *implementation of national policies for risk mitigation* as already called for in the 2007 UNCOPUOS Space Debris Mitigation Guidelines.
- Finally, it should be noted that, as for other space treaties and agreements, the *absence of specific definitions* of some critical terms (e.g. "imperative safety considerations") hinders the clarity of the Code and legal certainty required by all stakeholders, whether public or commercial. This is further an issue as States will be required to implement policies, and thus surely regulations, in the context of this Code which may lead to different definitions in different national jurisdictions.

2.1.4 Practical Impacts on Space Activities

The *foreseeable roles and responsibility of space faring nations include thus the following:*

1. Implementing the Code for its own activities, as a matter of principle, i.e. measures on operations and space debris control and mitigation, participation in the cooperation and information mechanisms;
2. Sharing SSA data and supporting international space traffic management;
3. Participation to the development of international space safety operations standards.

Organisational Aspects and Measures

- It should be noted that the Code does not give the EU itself any direct role/responsibility, insofar that the Code

[1] Note: space *security* refers to threats to space systems which are voluntary (i.e. aggressive nature), while *safety* refers to threats that are non-voluntary in nature (design errors, malfunctions, human errors, etc.).
[2] Article 2.4 of the UN Charter indeed states: "All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations."

will be subscribed by States and not international organisations.

- Furthermore *international spaceports*, with the presence on site of international teams for preparation of vehicle and/or payloads is another case in which international common rules on space operations safety may be necessary. Therefore, the scope of such international space operations coordination standards may be or may become substantially wider than appears at first sight.
- ESA may provide an important contribution to the establishment of international space safety operations standards by offering, among others, the organizational experience gained with running the European Cooperation for Space Standards (ECSS) secretariat.
- Finally, the cost of these measures on ESA and its operations remains to be evaluated and has been flagged as a central concern

2.1.5 ESA's SSA Programme

The European SSA System as defined in the SSA Preparatory Programme comprises three distinct segments:

- Space Surveillance – Ground based telescopes, UHF surveillance and S/X tracking Radars as well as survey and tracking payloads on hosting Spacecraft platforms, Data and Service Centres
- Space Weather – Ground based and space based sensors on hosting Spacecraft platforms and dedicated Space Weather Spacecraft, Data and Service Centres.
- Near Earth Objects – dedicated 1.5 and 3.5 metre telescopes, access to existing space based NEO payloads, deployments of new space-based sensors, Data and Service Centres.

In addition, transversal capabilities such as the SSA Tasking Centre, dedicated to the management, scheduling and planning of the SSA ground and space based sensors are planned to be included in the European SSA System.

Dual Civil-Military Nature of the European SSA System

Additional components to the SSA System may be added in the near future based on the SSA military User requirements compiled by the EDA (e.g. imaging, characterisation). They were released end of March 2010. Their financing together with the contribution of the military community to the financing of the dual parts of the system is channelled through the EU/EC participation to the SSA Programme in its development phase.

As Europe initiates its own Space Situational Awareness (SSA) preparatory programme, it is believed that discussions with relevant international space actors is a necessity to promote pertinent exchange of information and pursue, where applicable, coordination and cooperation. Furthermore, several international fora are being addressed by Europe to underline the value of SSA in support of safe and sustainable in-orbit operations. Among all these international actions, discussions with the United States, which were already initiated in 2008, stand as a critical building block.

Background on the ESA-US Space Situational Awareness (SSA) Discussions

Since the very inception and conception of the SSA programme, ESA and the US Department of State had contacts and meetings during which information and updates about the objective and the content of the SSA programme preparation on the European side and the SSA system on the US side were exchanged. ESA actually conceived the SSA programme with the intention of having (1) a regular dialogue with the US and (2) the establishment of an early identification of possible cooperation.

These exchanges were established with the US Department of State as it was confirmed by the US side to ESA that this Department should be the official contact on these matters. The specific branch of the Department of State responsible for these international exchanges is the Office of Missile Defense and Space Policy in the Bureau of International Security and Nonproliferation.

In order to foster a working-level dialogue on SSA, the US side offered to host a workshop, which was held on 25-26 June 2008 in Washington, DC. This workshop proved to be very successful in (1) identifying a number of general issues that required further discussion and in (2) identifying a number of opportunities for cooperation on topics relevant to SSA.

An informal meeting took place in early December 2008 with the Department of State to present an outline on the outcome relevant to SSA of the ESA Council Meeting at Ministerial Level of November 2008. A set of technical meetings were held in 2009.

Elements of a European Position Regarding SSA Cooperation With the US

The two overarching principles of Europe's position on SSA vis-à-vis the US should be the following:

- Considering that it will be several years before a European operational capability in SSA exists, Europe should secure to the maximum extent the data coming from the US on SSA. This also means that the existing stable relationship with the US must be maintained, allowing to secure the provision and transmission of such data.
- Europe should achieve in its SSA programme cooperation with the US in all relevant technical fields, including data standardisation and data policy.

These two general European objectives may further be translated into the four following objectives for ESA with regard to cooperation with the US on SSA:

1. Pursue close exchanges with the US on SSA taking into full account the upcoming European SSA governance principles, which are being currently defined;
2. Build a technical understanding and cooperation with the US around several SSA-related activities – for example to pursue the investigation of possible SSA data standardisation;
3. Develop, to the maximum extent possible, synergies between European and US systems to bring benefits to both sides with the aim of achieving interoperability.
4. Continue the existing space surveillance data cooperation, in particular regarding data coming from the US Strategic Command (STRATCOM) for the conduct of sound and safe operations in orbit of satellites that in many cases serve the European and the US communities of users.

2.2 Transparency and Confidence-Building Measures: Treaties, National Legislation, National Policies, and Proposals for Non-Binding Measures

by Brandon L. Hart

There are numerous "transparency and confidence-building measures" (TCBMs) within existing outer space treaties. Over the past several years, there have been several calls to develop non-binding "Rules of the Road" that establish responsible national behavior for outer space activities. Sometimes these are called "Rules of the Road," sometimes a "Code of Conduct" and some refer to them as "Best Practice Guidelines." I favor the term "Best Practice Guidelines" because the use of the words "rule" or "code" give the impression that the provisions they contain are binding – and are misleading for "voluntary" guidelines.

Frequently, the actual provisions contained in the proposed "Best Practice Guidelines" already exist in treaties, national legislation or national policy. TCBMs that are found in treaties are, of course, binding on nations party to the treaty. Many of the TCBM provisions contained in treaties have been recommended for addition in the non-binding proposals. I see little-to-no value in repeating binding treaty TCBMs in a "Best Practice Guidelines" that are by the terms of the document, non-binding. Adding treaty-based TCBMs to these non-binding documents seems to indicate that the treaty obligations, rather than being mandatory, are merely "best practices."

There are numerous TCBMs contained in the standard outer space treaties (the Outer Space Treaty, Liability Convention, Rescue and Return Agreement, and the Registration Convention). I will highlight a few TCBMs that exist in binding form for States party to the Outer Space Treaty.

Due regard: Article IX of the Outer Space Treaty provides at least a couple of important, binding TCBMs. The first TCMB to point out is the obligation for a State to operate in outer space with "due regard" for other States. Specifically, "[i]n the exploration and use of outer space … States Parties to the Treaty … shall conduct all their activities in outer space … with due regard to the corresponding interests of all other States Parties to the Treaty." Quite frankly, this one binding obligation binds States to some measure of responsible behavior.

International Consultations: Another TCBM found in Article IX of the Outer Space Treaty obligates States to “appropriate international consultations” in the event an activity it is planning in outer space "would cause potentially harmful interference with the outer space activities of other Parties. Specifically, “[i]f 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 … it shall undertake *appropriate* international consultations before proceeding with any such activity or experiment.” Though binding under international law, this provision contains enough wiggle room for States to ignore this obligation, even when they plan on blasting satellites with kinetic anti-satellite weapons (ASATs). For example, I am unaware of any “consultations” by China prior to its ASAT test January 11th, 2007. This ASAT test shattered a 750 kilogram satellite into over 1,000 pieces of debris measuring larger than 10 centimeters (roughly the size of a softball). An additional 40,000 pieces of debris were created measuring between 1 to 10 centimeters and about 2 million pieces of debris measuring between 1 millimeter and 1 centimeter. Even the small sizes are sufficient to damage or destroy operating satellites of other States – in low Earth orbit, these pieces are travelling at around 10 times the speed of a bullet. Furthermore, because of the altitude of the satellite China destroyed, 537 miles straight up, the debris will remain a threat to all satellites for over a hundred years. In spite of this, there were *no* international consultations.

A year later, the U.S. intercepted a malfunctioning spy satellite, also without entering “international consultations,” though at least the U.S. openly informed the public of its intended activity prior to intercepting the satellite. The U.S. also intercepted the satellite at a much lower altitude (133 miles) ensuring the resulting debris did not remain in orbit for long (all trackable debris has reentered the Earth's atmosphere over a year ago). Regardless, there were no “international consultations.” Some have argued consultations were not necessary, as the “would cause” language requires a certainty of damage, though this is unconvincing to me, as in context, the activity must only cause “potentially harmful interference.” Still, the text is vague – how much certainty for interference must be anticipated prior to triggering the requirement for international consultations? I am unaware of any examples *any* State *ever* following this binding TCBM.

Informing the public of activities: Article XI of the Outer Space Treaty provides for broad transparency. In relevant part, “Parties to the Treaty conducting activities in outer space … agree to inform … the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities.”

Informing of potential dangers to astronatauts: Article V of the Outer Space Treaty provides for informing other States of potential dangers it discovers in outer space. Specifically, “States Parties to the Treaty shall immediately inform the other States Parties … of any phenomena they discover in outer space, … which could constitute a danger to the life or health of astronauts.” This is yet another example of a binding, treaty obligation for transparency.

Opportunity for observations: Another broad treaty-based obligation for transparency is found in Article X of the Outer Space Treaty. It provides, in relevant part, “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.”

Futuristic rights: The Outer Space Treaty even provided for transparency for activities in space that are largely fanciful even today, over 40 years after the Treaty was in force. Specifically, Article XII provides, in part, “[a]ll stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity.”

As is apparent from just this short listing of TCBMs – they abound in binding form within existing treaties. The fact that States tend to ignore many of these binding obligations should not lead one to believe the creation of voluntary guidelines would be more effective – we should modify behavior to conform to existing treaty obligations and encourage other States to do the same, prior to or in lieu of creating non-binding guidelines.

Besides treaty obligations for TCBMs, national legislation also creates TCBM obligations. For example, one statute we are wrestling to implement at US Strategic Command is the “Space Situational Awareness Sharing Program” legislation (10 USC 2274). This legislation allows the Department of Defense to widely share data, information and services with both commercial and foreign entities. Specifically, 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 ...” This whole program focus on increasing transparency in outer space.

National space policies also allow for increased transparency. At the time of this symposium, the US National Space Policy noted that the Secretary of Defense “shall ... conduct space situational awareness for: the United States Government; U.S. commercial space capabilities and services used for national and homeland security purposes; civil space capabilities and operations, particularly human space flight activities; and as appropriate commercial and foreign space entities ...” More recently, President Obama has issued his new National Space Policy, which though similar to those of prior administrations, could be best differentiated for repeatedly calling for increased cooperation with other States and increased transparency in national space activities.

The point of all of these examples was to highlight the fact that a wide range of TCBMs for outer space activities already exist. They exist in binding form – in treaties, national legislation, and in national policies. Furthermore, a close inspection of current proposals for voluntary TCBMs (e.g., the Stimson Center's proposed “Rules of the Road” and the European Union's proposed “Code of Conduct”) reveals that a large portion of these documents merely repeat TCBMs already found in these other sources – and rather than being voluntary, are binding on States.

I am not opposed to the creation of voluntary TCBMs. To the contrary, I am in favor of them. But a close inspection should be made of these proposals. I offer a four recommendations for any such proposal:

1. It should not merely repeat binding obligations of existing space treaties (e.g., reaffirming commitments to treaty obligations);
2. It should not conflict with binding rights from existing space treaties (e.g., creating zones of sovereignty around satellites, which is contrary to both the free use of space provided for in Article I of the Outer Space Treaty and also the express prohibition against claims of sovereignty in outer space per Article II of theOuter Space Treaty);
3. It should not repeat or conflict with existing guidelines (e.g., Debris Mitigation Guidelines);
4. It should not be overly cost prohibitive. We want to encourage the responsible use of space, but regulations and rules should not create burdens that would decrease our competitiveness in space or create obligations that would be excessively burdensome (e.g., deorbiting satellites is often reasonable, requiring removal/clean-up of existing debris would be excessive).

In sum, TCBMs that establish responsible use of outer space are important. They already exist in several binding treaties, in national legislation, and in national space policies. If we began to follow existing obligations more fully, we would have less need to look to the creation of non-binding “best practices,” “codes of conduct” or “rules of the road.” Inasmuch as additional TCBMs are sought, they should be consistent with long-standing treaty obligations, avoid redundancy, and not be overly cost prohibitive.

2.3 Improving Space Security by Monitoring Launches of Satellites and Missiles Using Some Space-Based Assets

by Bhupendra Jasani

2.3.1 Introduction

Dedicated space launchers are dealt with in the Convention on Registration of Launched Objects into Outer Space that was adopted by the United Nations General Assembly in 1974 and went into force in 1976.[3] The convention requires states to provide to the United Nations with details about the orbit of each space object. A registry of launchings was already being maintained by the United Nations as a result of a UNGA Res. 1721B(XVI) in 1962.

The register is kept by the United Nations Office for Outer Space Affairs (UNOOSA) and includes:

- Name of launching State;
- An appropriate designator of the space object or its registration number;
- Date and territory or location of launch;
- Basic orbital parameters (Nodal period, Inclination, Apogee and Perigee); and

[3] United Nations General Assembly. Resolution adopted by the General Assembly on 12 Nov. 1974. UN Doc. A-RES-3235(XXIX) of 12 Nov. 1974. United Nations. 19 Aug. 2010 <http://www.unoosa.org/oosa/en/SpaceLaw/gares/html/gares_29_3235.html>.

- General function of the space object.

However, such information is generally provided by a State well after a launch has taken place. As of 1st January 2008, 51 States have ratified and four have signed the Convention.[4]

As for the launches of missiles, the most developed international instrument is the Hague Code of Conduct (HCOC) adopted on 25 November 2002 and recognised by the UN General Assembly on December 3, 2004 (UNGA Res. 59/91). The member states commit themselves to curbing the proliferation of ballistic missiles capable of delivering weapons of mass destruction (WMD). A missile could be launched as an anti-satellites (ASAT) weapon also. The Member States of HCOC also commit to provide pre-launch notifications (PLNs) on ballistic missile and space-launch vehicle launches (SLVs) and test flights and including annual information on the number and generic class of ballistic missiles and space launch vehicles launched during the preceding year. Although there is no formal Secretariat or implementing organization, Austria serves as the Immediate Central Contact (ICC) for the HCOC. Annual meetings are held in Vienna, where Subscribing States discuss implementation issues, including pre-launch notifications and annual declarations on space and ballistic missile policies.

On 8th December, 2005, 158 nations in the UN General Assembly voted in favour of UNGA Res. 60/62 supporting the HCOC and its importance and relevance was reaffirmed by the 63rd UN General Assembly on 17th October, 2008 in a new resolution UNGA Res. 63/64 that was supported by 159 UN Member States. As of May 20, 2009, 130 countries have subscribed to the HCOC.

Thus, the author has proposed a study to assess the global state of the art technology that exists today, but not used for detecting satellite and missile launches to monitor compliance with commitments made by state parties to the above conventions thereby enhancing space security. It is aimed at identifying sensors that are currently active and could help in the detection of satellite and missile launches worldwide in order to provide a verification tool for any future control regime for, for example, limiting missile tests or for monitoring an agreement on the Prevention of an Arms Race in Outer Space (PAROS). The technique can also be used to strengthen the United Nations Registration Convention by providing the UN notification of a launch of a satellite soon after it has been launched.

2.3.2 Space Based Systems

Observations of Preparations and Launches of Satellite Launchers

It is suggested that civil observation satellites might be used to monitor the preparation and launches of satellites. Two types of accessible observation satellites might be: such satellites in low earth orbits (LEO) as IRS, Ikonos, QuickBird, SPOT and WorldView-1; and satellites in the geostationary orbits (GSO) such as the US GOES and European Meteosat. For this, two characteristics are important: the spatial resolution i.e. the size of the spot on the ground "seen" by one particular point in the image or seen by a scanning sensor at the instant of observation; and the temporal resolution i.e. how frequently a satellite comes back to a particular point on the earth's surface. Clearly in the first instance, a number of satellites would be required to observe launches of satellites effectively. The revisit time for a single satellite in the LEO is too long. This is illustrated by the following four WorldView 1 images (Figure 1a to d) acquired over a period of two months using http://maps.google.com/maps web site over the North Korean missile launch site.

While it is possible to detect the preparations of a launch of a missile or a satellite launcher, to be more useful it is important to be able to observe more frequently. In other words, one needs a higher temporal resolution. A temporal resolution of a day or even a few hours may not be very useful in the case of a launch of a missile. In practice one requires a temporal resolution of few minutes. This could be achieved in two ways: one is to use several satellites launched by a single State in the LEO which may not be economically possible; and the other is to use satellites in the LEO launched by several states to improve the temporal resolution as well as share the economic burden. This is illustrated in Figure 2 in which orbits of a number satellites were plotted using the Analytical Graphics Inc. software. It can be seen that there are number of satellites operated by different countries in very similar orbits and, if used in cooperation, they could improve the temporal resolution. However, this would require cooperation between the space faring nations.

[4] United Nations Office for Outer Space Affairs. Convention on Registration of Objects Launched into Outer Space. 19 Aug. 2010 <http://www.oosa.unvienna.org/oosa/en/SORegister/index.html>.

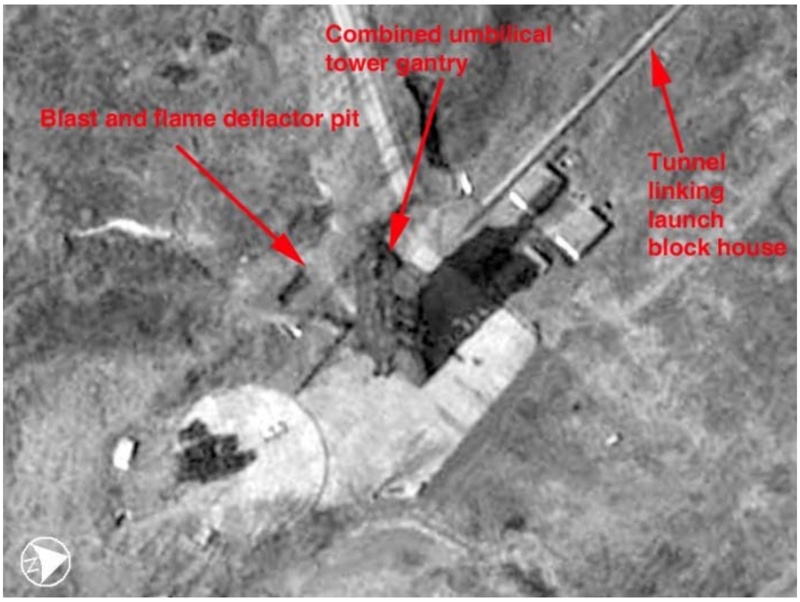


Figure 1a: 24 March 2009


Figure 1b: 2 April 2009

Figure 1c: 5 April 2009 the day the missile was launched

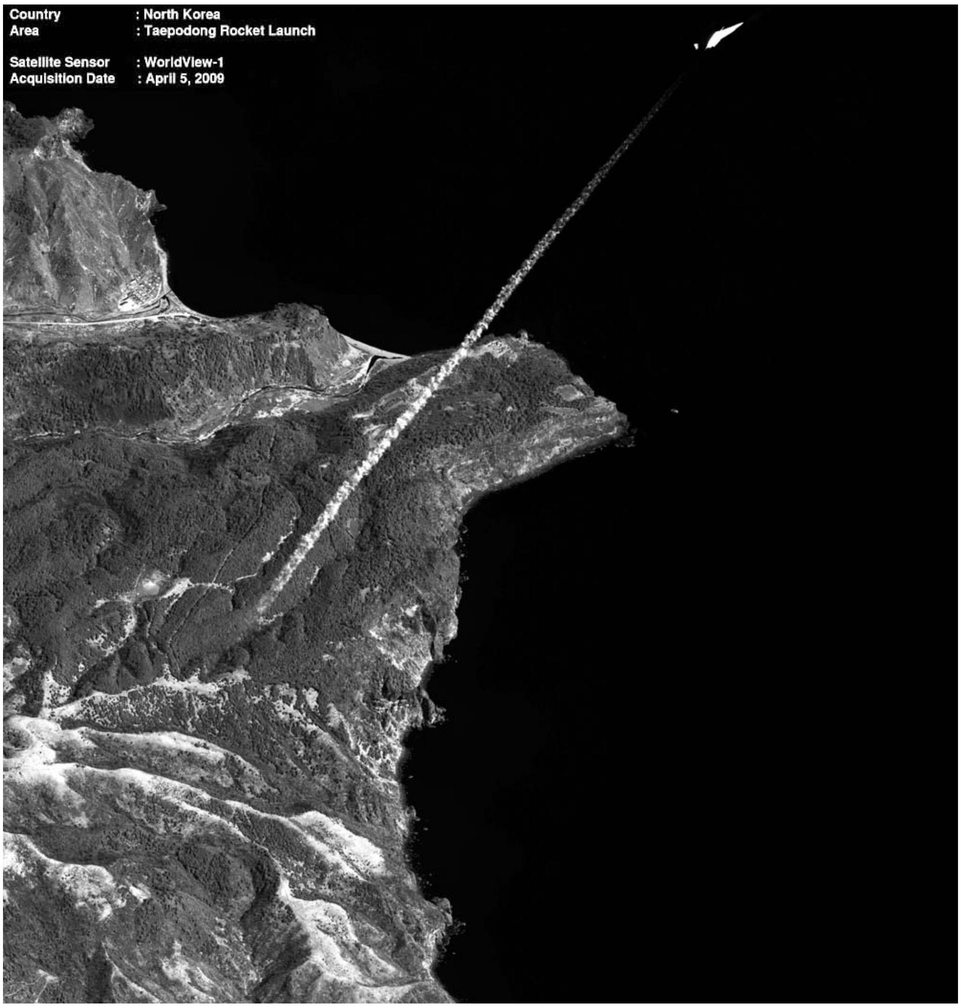


Figure 1d: rocket detected as it emerges bove the clouds on 5 April 2009

Figure 1. The North Korean missile launch site observed at least on four occasions by the US WorldView 1 satellite. Images were acquired from http://maps.google.com/maps web site.

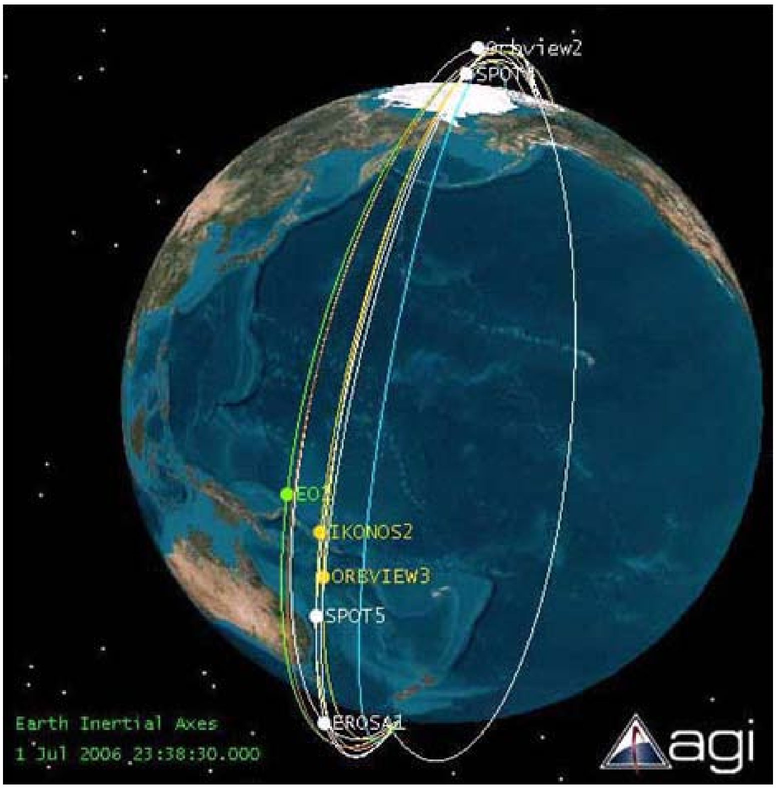


Figure 2: Orbits of a number of satellites are plotted using the AGI software to illustrate the improvement in the temporal resolution.

Another method, and probably more useful one, is to use satellites in the GSO.

Observations of Missile Plumes from GSO

There are essentially three sources of radiation: combustion gases and particles in the exhaust plume; heated parts of the engine, exhaust nozzle, missile skin surface due to aerodynamic heating and internal heat sources; and reflected radiation from outer space, ground and sun.[5] Generally the strongest of these is the radiation from the exhaust plume during the boost phase. The radiation emitted is mainly in the mid infrared (IR) portion of the electromagnetic spectrum at wavelengths between 2μm and 5μm (see Figure 3).[6] The spectrum from the exhaust of a tactical ballistic missile with liquid propellant in the boost phase has been calculated using NATO InfraRed Air TArget Model (NIRATAM) when the missile has reached an altitude of 10 km and shown in Figure 4 (in red).[7] In this figure the IR spectrum from Figure 3 is superimposed for comparison. It can be seen that the most important IR emission is from combustion gases CO2, H2O and CO.

Three factors that may affect the detection of this: one is the signal strength (i.e. brightness of the exhaust plume) and its wavelength; second the background (noise) against which the plume has to be detected; and third, the signal to noise ration. Most of the combustion associated with a missile takes place in the combustion chamber resulting in not only visible light but also infrared emissions that are associated with the vibrational state of the products.[8]

The IR spectra of liquid and solid plumes have similar spectral characteristics. This is evident from Figure 5.

[5] Beier, Kurt and Erwin Lindermeir, "Comparison of Line-by-Line and Molecular Band IR Modeling of High Altitude Missile Plume." Journal of Quantitative Spectroscopy and Radiative Transfer 105.1 (2007): 111-127.

[6] Forden, Geoffrey. "A constellation of satellites for shared missile launch surveillance." 9 July 2006. MIT's Program of Science, Technology and Society. 19 Aug. 2010 <http://web.mit.edu/stgs/pdfs/white%20paper--%20A%20Multinational%20Missile%20Launch%20Surveillance%20Network.pdf>.

[7] See note 5.

[8] Simmons, Frederick. Rocket Exhuast Plume Phenomenology. Reston (VA): American Institute of Aeronautics and Astronautics, 2000.

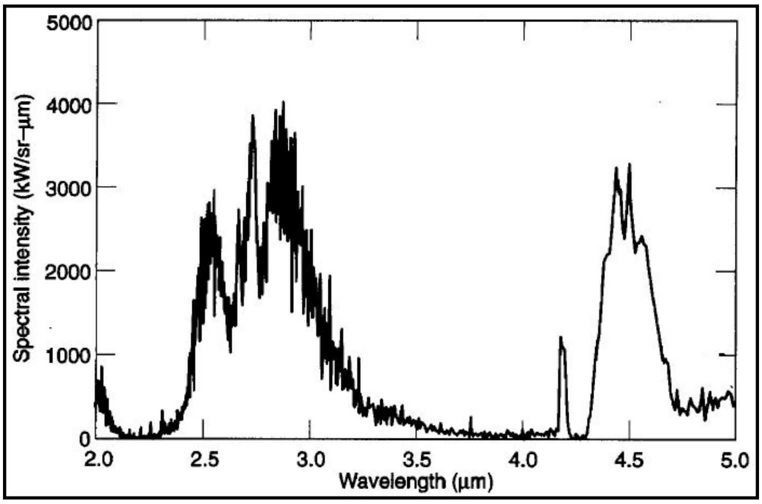


Figure 3: An infrared spectrum of a US Titan IIIB missile plume is shown below when it has reached an altitude of 18km. (Source: See Forden, 2006.)

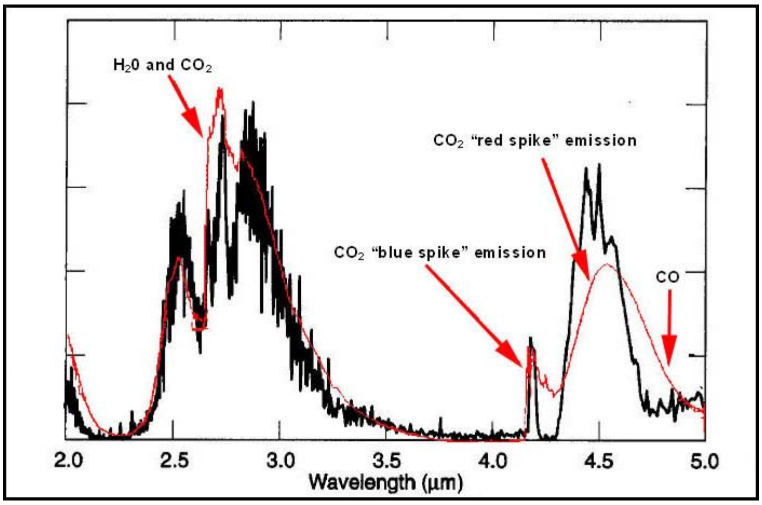


Figure 4: Spectrum of radiation from the plume of a tactical ballistic missile with liquid propellant in boost phase calculated using NATO InfraRed Air TArget Model (NIRATAM) is shown here when the missile has reached an altitude of 10 km (graph in red see Kurt Beier and Erwin Lindermeir, 2007).

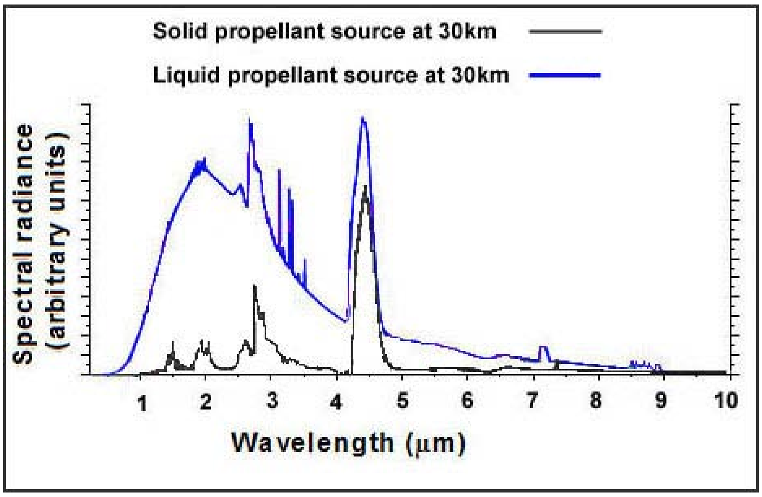


Figure 5: Comparison of spectra from solid and liquid propellants when the rocket has reached 20km altitude (Source: See Forden, 2006.)

Launcher State	Name of satellite	Date of launch	Sensors	Position in GSO
GSO				
USA	GOES-12	23072001	MODIS	75°W
	GOES-14	07072009	MODIS	89.5°W
European/ESA	Meteosat-8/MSG-1	29012004	SEVIRI	3.5°W
	Meteosat-9/MSG-1	21122005	SEVIRI	0° over Atlantic Ocean
Polar orbit				
Multinational/NASA	Terra	18121999	MODIS	
	Aqua (EOS-PM-1)	04052002	MODIS	

Table 1. Some of the potentially useful meteorological satellites for monitoring launches of missiles and satellite launchers.

Both the USA and the former Soviet Union deployed the so called early-warning satellites that detected the launches of missiles, space launchers and detection of nuclear detonations in outer space and in the earth's atmosphere. However, the data from these spacecraft are highly classified and therefore accessible to very few. Such satellites have IR sensors on board. Therefore, could not civil satellites with IR sensors on board be used to detect launches of satellites and missiles? While the classified satellites have been extremely useful in building confidence, at least between the US and Russia, there may be a possibility of using some meteorological satellites to detect launches of missiles and satellites. Meteorological satellites deploy electro-optical sensors sensitive in the IR region of the electromagnetic spectrum. Thus, it is worth examining the types of sensors on board civil meteorological satellites and see whether they can be used for early warning application.

Basically two types of orbits are used for such weather satellites. Polar orbiting in which satellites fly at relatively low altitudes of around 800 kilometres above the Earth, and can provide information based on a relatively high spatial resolution. However, a disadvantage is that when only one polar satellite is deployed, the same spot on the Earth is visited only two times a day requiring more than one polar satellite with different equatorial crossing times in order to increase the temporal resolution.

At present two Earth Observation Satellites (EOS), Terra (EOS AM-1) and Aqua (EOS PM-2), are operational. The main sensor is MODIS (Moderate Resolution Imaging Spectroradiometer). It has 36 spectral channels with high radiometric (12 bit) and moderate spatial (1000, 500 and 250 m) resolution see Table 1).

The second is the GSO in which satellites are in the equatorial plane at an altitude of some 36,000 kilometres above the Earth. These have an orbital period similar to that of the Earth's rotation on its axis so that the satellite always views the same area. A disadvantage is the relatively high altitude limiting spatial resolution. From the IR spectrum of the rocket plume of the US Titan IIIB missile shown in Figure 3, there are at least three peaks identified between the wavelength ranges of about 2.3µm and 4µm. Two more peaks are located between wavelengths ranges of 4.15µm and 4.25µm and 4.25µm and 4.75µm. In Figure 6, spectral sensitivity of various sensors on board civil commercial meteorological satellites is shown. The above spectral responses of the Titan IIIB missile plume are also shown in Figure 6 for comparison. It can be seen that the spectral wavelengths of MODIS and SEVIRI sensors coincide with those of the Titan IIIB plume in spectral ranges 4.1µm and 4.2µm and 4.4µm and 4.65µm thus, potentially enabling the detection of a Titan IIIB missile by civil weather satellites (Table 1). This may offer a method for States other than the US and Russia to obtain early warning of preparations and launches of missiles and satellite launchers.

2.3.3 Way Forward

Clearly the above brief resume indicates the possibilities of using open sources of information to verify some of the existing arms control and confidence-building related measures such as the UN Registration Convention and the HCOC and possible future treaties on the limits of missile testing and PAROS.

Interstate relations rests considerably on each knowing other's economic and military capabilities. Often this is enhanced by having such agreements as confidence-building measures and arms limitations. With increasing capabilities of civil/commercial satellites, their use in this process becomes very important. This is further helped by the fact that many more states are launching and operating advanced satellites. It would be useful if such activities were carried out in cooperation under an international or a regional agency.

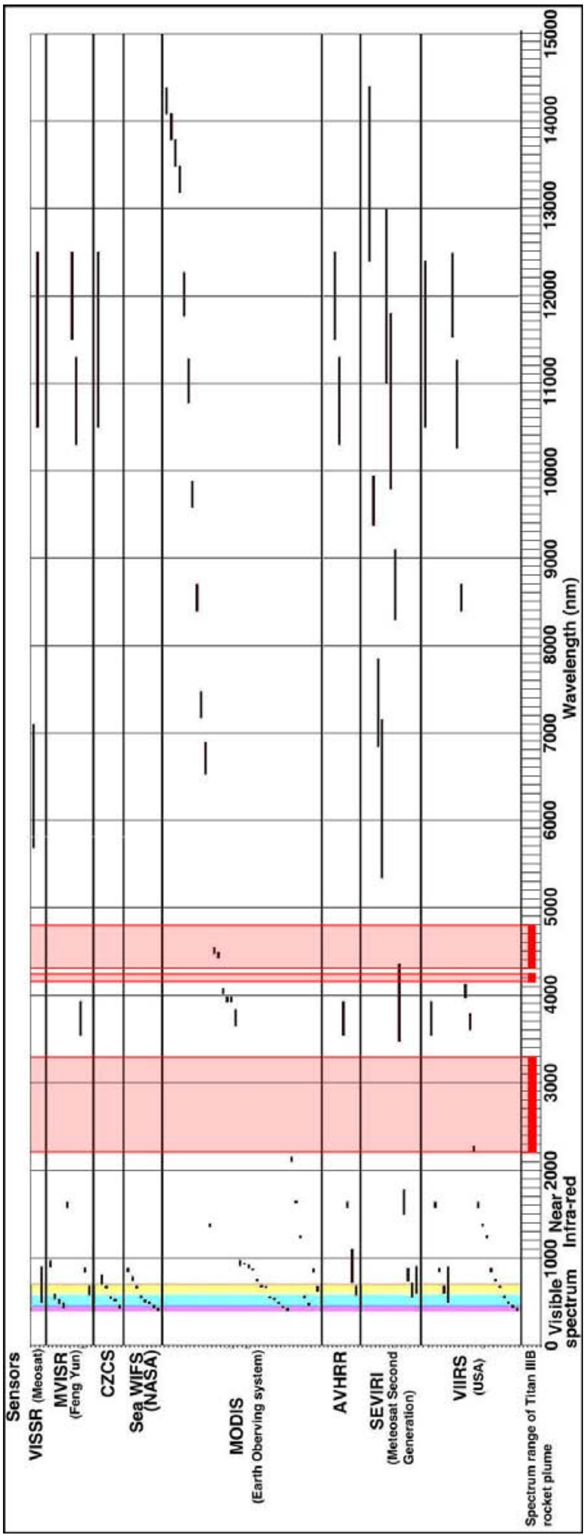


Figure 6. This shows spectral sensitivity of various civil meteorological satellites. The IR signature of the US Titan IIIB missile is also shown.

A multinational (European Satellite Centre, Madrid) and an international organisation (the International Atomic Energy Agency) have started to use satellite data as a part of their verification and confidence-building tasks. The most important issue to be introduced into any treaty is the question of the use of commercial observation satellites as a verification tool. Each bilateral arms control treaty between the USA and Russia has a clause under which the parties are prohibited from any kind of interference with each other's national technical means (NTM) of verification. Observation satellites form a key verification tool. Thus, several types of defence related satellites are protected, at least by such treaties, from interferences and from attack. With more and more use of commercial satellites for verification and confidence-building measures, the range of space assets with certain degree of immunity increases making space that much more secure.

2.4 Space Security Lessons from "Terrestrial" Arms Control

by Richard L. Williamson

2.4.1 Introduction

For over a century, the international community has worked to forbid or limit types of weapons, define the acceptable conditions of their use, or specify their allowed location. Many of these measures have been designated "arms control". Studying their successes and failures can provide useful information when considering measures to reduce the potential for adverse international security consequences from the ever broader uses of outer space.

Arms control needs to be differentiated from two closely related concepts: First, arms control is not the same as peace treaties or boundary agreements, which sometimes constrain armament. For example the 1955 Austrian State Treaty – that reunified Austria – forbids that country from possessing nuclear, chemical or biological weapons, or any "self-propelled or guided missiles." Second, arms control is not the same as humanitarian law, a branch of the laws of war. Unlike arms control, humanitarian law does not limit the number, type or location of a weapon; it only limits how weaponry can be used in wartime. For example, the Geneva Conventions forbid countries from targeting civilians. Finally, it should be noted that when discussing arms control, "terrestrial" needs to be in quotes, as some of the most important arms control agreements constrain medium and long-range ballistic missiles, which transit space when tested or used.

2.4.2 Lessons

The following are some of the specific lessons from arms control which may have relevance to international security in space:

> It is easier for countries to forego the right to acquire militarily significant capabilities than to scrap weapons they already possess.

Requiring a country not to utilize militarily relevant capabilities that it possesses during actual combat operations may fail because it is too tempting to use them if a country believes they will significantly increase the chances for victory. Moreover, there can be political difficulties for a country that proposes to abandon a weapons capability acquired at great cost and sometimes at great risk. This does not mean that existing capabilities have never been given up. However, doing so was either the product of very difficult negotiations, such as the Intermediate Range Nuclear Forces (INF) agreement between the United States and the Soviet Union, or was the result of atypical circumstances, such as South Africa destroying its existing nuclear weapons when changing from apartheid to majority rule.

The post-World War II arms control agreements have frequently utilized this principle, banning weapons outright or limiting the location in which weapons can be placed. For example, there are treaties that ban nuclear weapons in a variety of locations including in Antarctica, on the moon, in orbit, on the seabed, in Latin America, and in several other regions. No nuclear weapons were in those locations when banned. Another example is the ENMOD treaty which forbids the modification of naturally occurring processes as a weapon of war.

> Incremental progress may be the only realistically available alternative.

Reaching agreement on a comprehensive, global scheme of reductions, permanent ceilings or weapons prohibitions – and the necessary verification and confidence-building measures to facilitate compliance – is an extremely difficult process, perhaps too difficult to accomplish, if history is any guide.

After the Second World War, there were extensive efforts under UN auspices to negotiate "general and complete disarmament". Although many years were spent in the effort, nothing of consequence came from these negotiations. A more modest attempt was then made to negotiate a complete ban on nuclear weapons testing. This also proved too difficult. Once that effort was abandoned, Kennedy and Khrushchev were able to reach rapid agreement on the Limited Test Ban Treaty, which barred all nuclear testing except that conducted underground.

It is generally easier to reach agreement on one aspect of a problem than on a comprehensive approach. Success on that one aspect may build confidence that allows nations to take further steps. Following the LTBT, additional arms control agreements, both bilateral and multilateral, were reached in fairly rapid succession.

> Bilateral agreements are sometimes necessary, but multilateral agreements are generally better.

Negotiating multilateral agreements often poses some of the same difficulties noted above concerning comprehensive ones. Moreover, on occasion the agreement of only two countries it is needed to deal with a particular international security threat. Nevertheless, whenever feasible, it is better to negotiate a broader agreement. There are two reasons for this:

First, a multilateral agreement imposes duties on a country, which it owes to all of the other parties to that treaty. If a country has a conflict or controversy with another country, that is not a legal justification for the aggrieved country to violate the treaty or to terminate the treaty except in accordance with the treaty's terms. This tends to enhance international stability.

Second, technology does not stand still. A country which was not relevant to a particular treaty when it was negotiated may well become so over time. For example, the number of countries capable of supplying manufactured goods or parts which are specially designed or prepared for nuclear applications has risen steadily.

An example of the problems that arise when only bilateral agreements are concluded is the INF treaty. It prohibited the United States and the Soviet Union from possessing ground-launched nuclear delivery vehicles – both ballistic and cruise missiles – with a range between 500 kilometers and 5500 kilometers. Given subsequent developments including the arms race between India and Pakistan, the deployment and international sales of missile capabilities by North Korea, and the current controversy over ballistic missile testing by Iran, it would have been far better to follow up the INF agreement with a multilateral one.

Treaties and other binding instruments generally obtain better compliance than soft law instruments.

In recent years, international law scholars have spent considerable efforts investigating compliance with "soft law". The underlying premise of soft law is that some kinds of international agreements are understood by the parties to be only political expressions of intent, and are not legally binding. Soft law may be easier to negotiate and amend, and be more flexible than treaties. If compliance with soft law is as good as with binding instruments, the thinking went, it would be advantageous for the international community to use soft law more often and deemphasize binding agreements. In fact, compliance with treaties is far from perfect, and there are cases of good compliance with soft law instruments. Nevertheless, treaties work better. There are several reasons for this difference. Countries fear retaliation, and know from experience that a broader and more substantially adverse reaction is likely when there is a violation of a treaty. An example is the virtually unanimous, strong reaction to Iraq's aggression against Kuwait in clear violation of the United Nations Charter. The reaction is almost always more muted when a soft law norm is not followed. A second reason is that nearly all countries place value on being viewed as a responsible member of the international community. Without that reputation, other countries will not be willing to enter into new agreements with the offending country. In addition, violating a treaty (or threatening to do so) may bring about significant domestic political resistance in democracies, as Ronald Reagan discovered when he sought to terminate the Anti-Ballistic Missile Treaty without complying with its termination provisions. No such outrage was expressed many years later when George W. Bush terminated the same treaty in accordance with its terms.

Complex regimes work better than simple ones.

A complex international regime is one characterized by having multiple treaty instruments supporting the same general goals. These are further bolstered by important compliance rules for international organizations and frequently supplemented by a significant body of closely related soft law. Such complex regimes tend to have better compliance than simple ones. Perhaps the best example of a complex arms control regime is the one designed to halt the spread of nuclear weapons. The Nuclear Nonproliferation Treaty (NPT) establishes two classes of countries, those which can and those which cannot possess nuclear weapons. The international community usually resists proposed measures that create juridical inequality among countries. Nevertheless, the NPT is the substantive treaty with the most adhering countries (exceeded in adherence only by a few constitutive treaties like the UN Charter). The NPT regime is enhanced by several nuclear weapons free zones such as the Treaty of Tlatelolco, which establishes a nuclear weapons free zone for Latin America; a physical protection convention requiring careful control of nuclear materials; the active work of the International Atomic Energy Agency (IAEA) which carries out inspections that provide essential verification of these treaties; and a supplemental protocol which vastly expands the IAEA's authority to inspect for undeclared nuclear facilities. These are further supplemented by soft law provisions such as the Nuclear Suppliers Group guidelines, and even the terms of the Missile Technology Control Regime (MTCR). There are other examples of complex regimes outside of the arms control field, including those for international trade, and the Antarctic. Some observers might conclude that space law has reached a critical mass where it is becoming a complex regime.

There is no substitute for wisdom in treaty provisions.

Treaties that leave large loopholes invite noncompliance with the treaties' purposes. Fixing such defects after the fact may be impossible or may require a great deal of work to rectify. An example is the pre-World War II naval accords, which limited the number of battleships and aircraft carriers each of the participating parties was allowed to possess. Unfortunately, no limits were placed on other very large but nevertheless somewhat smaller warships. This led countries to look for ways to circumvent the purposes of the treaties, with Japan building up a large fleet of vessels just below the treaties' size limits. Another example is the NPT, which places several duties on all parties to that agreement. However the duty not in any way to assist other countries with nuclear weapons was only placed on the nuclear weapons states. The theory at the time was that only the nuclear weapons states would be able to assist other country's weapons programs *per se*. That turns out to be false, as firms in a number of the most developed countries have the capability to assist other countries' nuclear weapons efforts even though the companies are headquartered in countries that do not possess nuclear weapons. If the provision had applied to all countries, it would have been very helpful to stop certain kinds of cooperation with Pakistan's nuclear programs and those of several other states.

Treaties without international verification regimes invite violations.

Not every arms control agreement has required a special verification scheme. The reason is that sometimes, national intelligence systems can readily detect noncompliance. An example is the Seabeds Arms Control Treaty. Placing nuclear weapons on the seabed would run a high risk of being detected by the naval forces of any country. However, there are many circumstances where national intelligence systems alone will not suffice. Moreover, even if violations can be detected, countries may fear the loss of their intelligence assets and methods if they provide proof to the world community that a country has cheated. Finally, as discussed below, technological developments may make verification much more difficult, though improvements in verification technologies can have the opposite effect. For all these reasons, it is normally highly advantageous to include verification provisions in any such treaty.

By far the most serious violation of any arms control agreement in the post-World War II era was by the Soviet Union. The 1972 Biological Weapons Convention contains no verification provisions. For years after it became a party to that treaty, the USSR continued a large-scale biological weapons program. A disastrous release of anthrax occurred in the Ural Mountains area in 1979, four years after the Soviet ratification of the treaty. In 1992, following the breakup of the Soviet Union, Russia's President Boris Yeltsin confirmed that the release had been from a military program.

A good example of technology making verification more difficult can be seen with uranium enrichment. The gaseous diffusion enrichment plants used by the nuclear weapons countries were so large and required so much electricity that it was assumed that any such facilities could be detected by national intelligence systems. Largely for this reason, the NPT only requires IAEA safeguards – international inspection – for declared nuclear facilities, not clandestine ones. However, in the case of Iran, we are now seeing the verification difficulties which have arisen from the development of a different enrichment technology, in this case centrifuge enrichment, which is far easier to conceal.

It should also be kept in mind that treaties which outlaw possession of a weapons system or associated technology, or which ban them from certain locations, are usually easier to verify than ones that place some limit on the number of the weapons. Where there is a total ban, any possession detected is a violation of the agreement. In contrast, accurately detecting and counting to assure that a limit has not been exceeded has sometimes been possible. However, doing so can be difficult, and may require special measures – such as the provisions of the US-Soviet strategic arms treaties barring the countries from using “deliberate concealment measures to impede verification,” and requiring silo covers to be opened for satellite inspection at particular times.

Treaties not joined by major players are occasionally useful, but should be avoided if possible.

The international community should not be unwilling to act just because an important player is not willing to join a treaty regime. After all, there are several examples where important countries have initially chosen to stay out of multilateral arms control regimes but the treaty effort was nevertheless worth undertaking. For example, France, China, Brazil, Argentina and several others originally rejected the NPT, yet later adhered to it. Even if a country does not adhere, norms contained in a widely supported treaty regime may have some influence on the country's behavior. For example, although India has steadfastly rejected the NPT, it has been quite responsible with respect to its nuclear export policies.

On the other hand, wherever possible, it is preferable to involve all of the countries that are relevant, or which might become so in the near future, as parties to the treaty. There are potentially serious negative consequences where that is not the case. For example, in addition to their other problems, the pre-World War II naval accords had the major defect that neither Germany nor the Soviet Union was a participant. Hitler's buildup of naval capabilities following his denunciation of the Treaty of Versailles violated no agreement with the United States, which was not a party to the Versailles Treaty. Perhaps Hitler might have exercised more caution if Germany were a party to those naval accords, the violation of which would mean violating treaties to which the world's largest industrial power was party. Another example is the Landmines Treaty. The United States was an early leader in trying to bring about restraint on the international trafficking in landmines, which was causing severe suffering on four continents. However, key nongovernmental organizations and several governments insisted on treaty provisions that the United States made clear it could not accept. This led the US to stay out of the treaty regime. Prior to the negotiation of that treaty, the U.S. Congress had passed legislation forbidding the export of landmines except for use by the U.S. military. After the treaty was concluded over American objections, an angry Congress rescinded that legislation.

> While experience with one agreement can be very helpful in crafting another, great care should be taken in simply copying provisions.

It can be temping to recycle approaches and provisions which seem to have worked. After all, reinventing the wheel with each new treaty can be a waste of effort. Nevertheless, using identical provisions in significantly different situations can lead to serious problems. A key arms control example comes from the reuse of a provision from the LTBT. That treaty contains a withdrawal provision that allows a state to pull out of the treaty regime after giving 90 days notice, but requires the state to explain the circumstances related to the purposes of the treaty that caused it to do so. That provision was sensible for that treaty. Under its terms, a country which already possessed nuclear weapons retained the option of testing them underground. Allowing a relatively short time frame from announcement to termination was unlikely to radically alter existing strategic relationships, since atmospheric testing is not that much more militarily beneficial than underground testing. Unfortunately, nearly identical language was used for the NPT. In the non-proliferation context, a short notice period for denunciation risks upsetting global or regional security. As we have seen with North Korea, and as we fear with respect to Iran, a state can put itself in a position to have nuclear weapons on short notice while still complying with the letter but not the spirit of its NPT obligations. Other affected states do not have time to adopt effective counter-measures. Thus, a provision that posed no real problems for the international community in the LTBT turned out to be a real mistake in the case of the NPT.

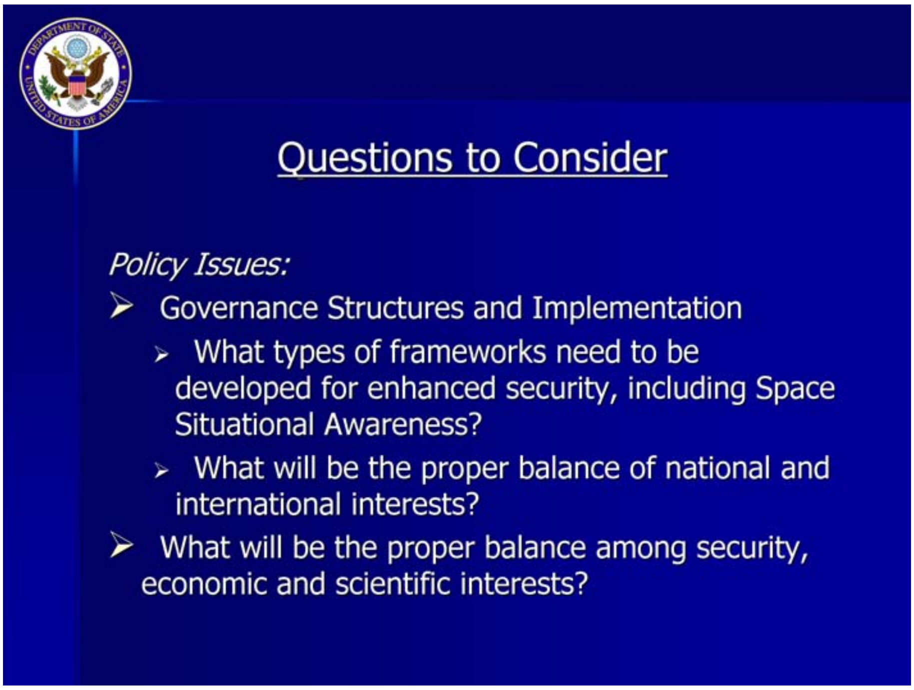
2.4.3 Conclusion

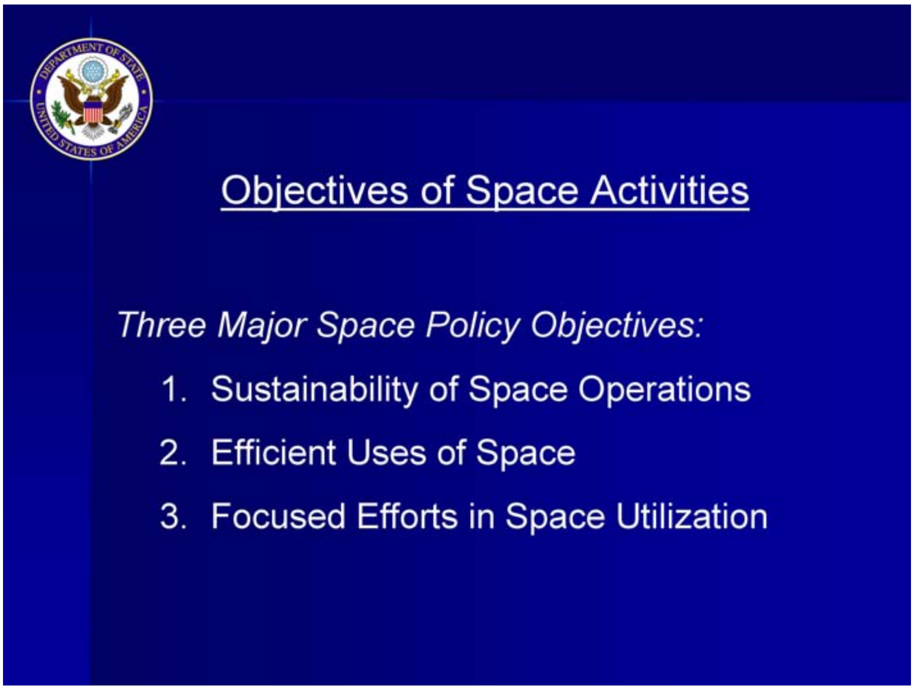
Few observers would consider arms control an unqualified success. Yet it is clear that arms control agreements have made important contributions to international security. The history of arms control contains many lessons – often illuminating mistakes that should be avoided – which could assist in building a space law regime that will serve the security interests of the international community and its individual space-faring members. In some cases, arms control approaches that work can be modified for direct use in a space security regime, though the trap of re-using provisions without careful consideration of differences in circumstance must be avoided. The new National Space Policy announced by the Obama administration as this section was being written is congruent with many of the suggestions made here.

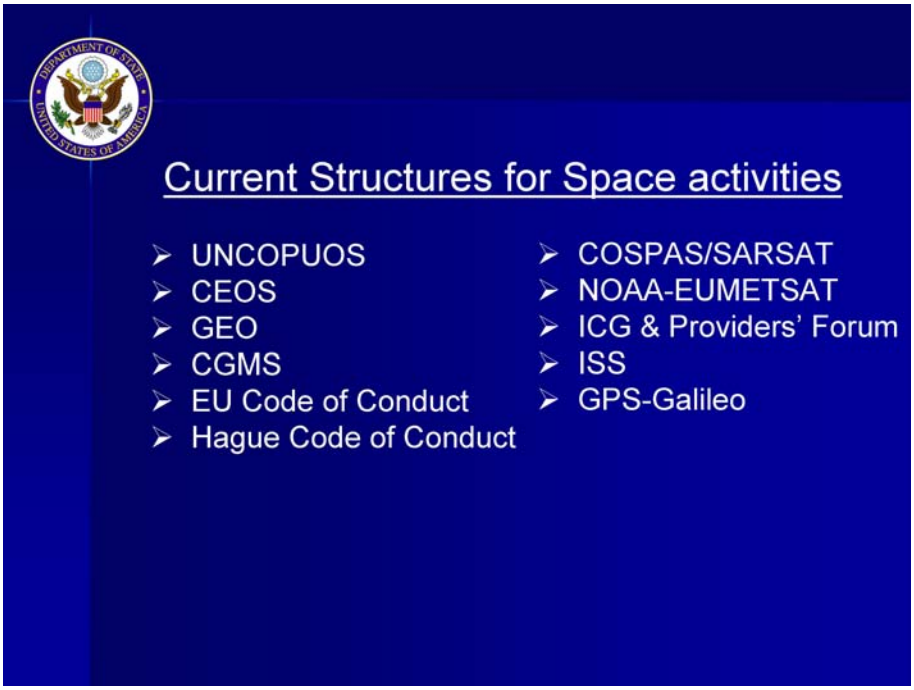
2.5 Space Behavior: Proposed Mechanisms for Enhanced Security, PowerPoint presentation

by Kenneth Hodgkins


Key Observations
Space utilization growing among developed and developing countries
Space systems are part of the Global Critical Infrastructure
Cooperation is Necessary
Need for Safe & Responsible behavior to protect space for current and future operations


Questions to Consider
Policy Issues:
Governance Structures and Implementation
What types of frameworks need to be developed for enhanced security, including Space Situational Awareness?
What will be the proper balance of national and international interests?
What will be the proper balance among security, economic and scientific interests?


Objectives of Space Activities
Three Major Space Policy Objectives:
1. Sustainability of Space Operations
2. Efficient Uses of Space
3. Focused Efforts in Space Utilization


Current Structures for Space activities
➢ UNCOPUOS
➢ CEOS
➢ GEO
➢ CGMS
➢ EU Code of Conduct
➢ Hague Code of Conduct
➢ COSPAS/SARSAT
➢ NOAA-EUMETSAT
➢ ICG & Providers' Forum
➢ ISS
➢ GPS-Galileo


Existing Mechanisms Characteristics
Governmental v. Technical Level
Informal v. Formal
Existing & Planned Systems
Technical Exchange
Users in Mind
Focused on a Specific Application
Separately Operated Systems Seamless


Long-Term Sustainability of Space Activities
Initiative proposed by France in UNCOPUOS
Item adopted in 2009 for work in STSC
Close coordination with major satellite operators and key members of the Committee
Working group established this year under leadership of Peter Martinez (South Africa)
Conclude work in 2012 /13 with adoption of best practices guidelines

2.6 Developing Agile and Adaptive Space Transparency and Confidence-Building Measures

by Peter L. Hays

For decades space capabilities have benefitted humanity and provided the United States with key advantages. These advantages, however, are now being challenged for a variety of reasons including the rise of China as a near peer competitor in space and elsewhere, emergence of increasingly capable actors worldwide that are developing and employing spacepower, U.S. difficulties in finding and implementing its best path forward for space, and the global economic meltdown. The trajectory of spacepower development is approaching an inflection point where business as usual will no longer serve U.S. interests – a point where the United States must consider different approaches or face prospects of eroding space leadership and diminishing returns from its space investments. To become more agile and adaptive in developing spacepower the United States should improve its strategic-level management and organizational structures for implementing goals from the National Security Strategy and new National Space Policy (NSP) as well as the ongoing Space Posture Review (SPR) development effort. The United States needs a deliberate, comprehensive, long-term, and consistent approach that draws on all instruments of power from all levels of government and focuses on national security space (NSS) and other critical parts of its space enterprise. In particular, the United States needs to reconsider Transparency and Confidence-Building Measures (TCBMs) including arms control and find better ways to leverage state-of-the-world commercial and international space capabilities.

The evolution of space capabilities and negotiations during the Cold War provides an essential foundation for evaluating the current prospects for space TCBMs. Three major lessons emerge from superpower space security developments: First, the superpowers used space to bolster their strategic warning, communications, and nuclear force structure in significant ways and also conducted extensive testing and limited deployments of anti-satellite (ASAT) weapons, but both sides chose to end their ASAT deployments without reaching a formal space arms control agreement. Second, the superpowers devoted considerable effort towards negotiations on ASAT arms control and on the Defense and Space Talks in the 1970s and 1980s but were unable to come close to signing any treaties, agreeing to space "rules-of-the-road," or even defining what constitute offensive or defensive space systems. Finally, all the ASAT testing, deployments, and deactivations show that some level of TCBMs and stability can be achieved without formal agreements. For open, pluralist democracies like the United States, arms are *always* controlled as a part of normal debates over guns versus butter and open dialogue about the strategic utility of specific weapons systems. These TCBMs hold the potential to become increasingly important for other actors if they choose to embrace democratic processes, publicly debate guns versus butter issues, and engage in transparent dialogue over the strategic utility of space weapons.

As the most important first step in bolstering space TCBMs, the United States and others should work harder to extend and achieve more universal adherence to the Outer Space Treaty (OST) regime. It simply does not make sense to create new structures when this foundational piece of international space law still has significant gaps in terms of precedence and compliance with existing norms. Particular areas that are underdeveloped within the OST regime include the Article VI signatory responsibilities for authorization and continuing supervision over activities of non-governmental entities in space and the Article IX obligations for signatories to undertake or request appropriate international consultations before proceeding with any activity or experiment that would cause potentially harmful interference. One key way the United States can continue supporting these OST obligations is by continuing to make progress on sharing space situational awareness (SSA) data worldwide. Following the January 2007 Chinese ASAT test, the February 2009 collision between Iridium and Cosmos satellites, and the 2010 creation of the Space Data Association (SDA), there is increasing focus on space debris and growing motivation to provide SSA data to users in more timely and consistent ways. One excellent specific goal would be creation of a U.S. Government operated data center for ephemeris, planned maneuvers, and propagation data for all active satellites. Users would voluntarily contribute data to this center, perhaps through a GPS transponder on each satellite, and the data would be constantly updated, freely available, and readily accessible so that it could be used by satellite operators to plan for and avoid conjunctions.[9] Consideration should also be given to the utility and modalities of creating or transitioning such a data center to international auspices.[10] Difficult issues that inhibit progress on sharing SSA data include liability and proprietary concerns; data formatting standards and compatibility between propagators and other cataloguing tools, and security concerns over exclusion of certain satellites from any public data. Developing and institutionalizing better ways to address these existing obligations under the OST regime could be one of the most direct and important steps in dealing with many of the most significant current international space security concerns.

Beyond the OST, efforts to craft comprehensive top-down space arms control or regulation still face all of the significant problems that plagued attempts to develop such mechanisms in the past. The most serious of these problems include: disagreements over the proper scope and object of negotiations; basic definitional issues about what is a space system and how they might be categorized as offensive or defensive and stabilizing or destabilizing; and daunting questions concerning how any agreement might be adequately verified. These problems relate to a number of very thorny specific issues such as whether negotiations should be bilateral or multilateral and the venue for discussions, what satellites and other terrestrial systems should be covered, and whether the object should be control of space weapons or TCBMs for space; questions concerning which types of TCBMs such as rules of the road or keep out zones, for example, might be most useful and how these might be reconciled with existing space law such as the OST; and verification problems such as how to address the latent or residual ASAT capabilities possessed by many dual-use or military systems or deal

[9] SSA issues are framed by specialized concepts and jargon. Conjunctions are close approaches, or potential collisions, between objects in orbit. Propagators are complex modeling tools used to predict the future location of orbital objects. Satellite operators currently use a number of different propagators and have different standards for evaluating and potentially maneuvering away from conjunctions. Maneuvering requires fuel and shortens the operational life of satellites. Orbital paths are described by a set of variables known as ephemeris data; two-line element sets (TLEs) are the most commonly used ephemeris data. Much of this data is contained in the form of a satellite catalog. The United States maintains a public catalog at www.space-track.org. Other entities maintain their own catalogs. Orbital paths constantly change, or are perturbed, by a number a factors including Earth's inconsistent gravity gradient, solar activity, and the gravitational pull of other orbital objects. Perturbations cause propagation of orbital paths to become increasingly inaccurate over time; beyond approximately four days into the future predictions about the location of orbital objects can be significantly inaccurate.
For more about SSA concepts see: Weeden, Brain "The Numbers Game," The Space Review. 13 July 2009. 19 Aug. 2010 <http://www.thespacereview.com/article/1417/1>.
For more details about this approach and other space security ideas fostered by meetings between the Department of Defense Executive Agent for Space and the Chief Executive Officers of commercial satellite communications providers see: McGlade, David. "Commentary: Preserving the Orbital Environment." Space News, 19 February 2007: 27.

[10] For an outstanding and detailed analysis of the benefits and challenges associated with creation of an international data center see: Colonel Cox, Lee-Volker. "Avoiding Collisions in Space: Is it Time for an International Space Integration Center?" 30 Mar. 2007. 19 Aug. 2010 <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA469676&Location=U2&doc=GetTRDoc.pdf>.

with the significant military potential of even a small number of covert ASAT systems. New space system technologies, continuing growth of the commercial space sector, and new verification technologies interact with these existing problems in complex ways. Some of the changes would seem to favor arms control and regulation, such as better radars and optical systems for improved SSA and verification capabilities, technologies for better space system diagnostics, and the stabilizing potential of microsatellite-based redundant and distributed space architectures. Many other trends, however, would seem to make space arms control and regulation even more difficult. For example, micro- or nanosatellites might be used as virtually undetectable active ASATs or passive space mines; proliferation of space technology has radically increased the number of significant space actors to include a number of non-state actors that have developed or are developing sophisticated dual use technologies such as autonomous rendezvous and docking capabilities; and growth in the commercial space sector raises issues such as how quasi-military systems could be protected or negated and the unclear security implications of global markets for dual-use space capabilities and products.

The history of formalized, top-down approaches to space arms control repeatedly has shown they are not likely to be the most fruitful ways to advance space security, a point strongly emphasized by Ambassador Donald Mahley in February 2008: "Since the 1970s, five consecutive U.S. administrations have concluded it is impossible to achieve an effectively verifiable and militarily meaningful space arms control agreement."[11] Nonetheless, in ways that seem both shrewd and hypocritical, the Chinese are developing significant counterspace capabilities while simultaneously advancing various proposals in support of prevention of an arms race in outer space (PAROS) initiatives and pursuing the Chinese-Russian draft treaty on Prevention of Placement of Weapons in Outer Space (PPWT) introduced at the Conference on Disarmament in February 2008. For the PPWT in particular, while it goes to considerable lengths in attempting to define space, space objects, weapons in space, placement in space, and the use or threat of force, there are still very difficult and unclear issues with respect to how specific capabilities would be defined. An even more significant problem relates to all the terrestrial capabilities that are able to eliminate, damage, or disrupt normal function of objects in outer space such as the Chinese direct ascent ASAT. One must question the utility of an agreement that does not address the security implications of current space systems to support network enabled terrestrial warfare, does not deal with dual-use space capabilities, seems to be focused on a class of weapons that does not exist or at least is not deployed in space, is silent about all the terrestrial capabilities that are able to produce weapons effects in space, and would not ban development and testing of space weapons, only their use.[12] Given these glaring weaknesses in the PPWT it seems plausible that it is designed as much to continue political pressure on the United States and derail U.S. missile defense efforts as it is to promote sustainable space security.

In the evolving security environment the United States clearly faces greater challenges in attempting to develop and implement policies designed to ensure space continues to provide sustainable and enduring benefits. Policy statements including the interim SPR submitted to Congress in March and the Fact Sheet on U.S. National Space Policy released in June 2010 indicate the United States will "ensure cost-effective survivability of space capabilities" and "develop and implement plans, procedures, techniques, and capabilities" necessary for mission assurance including "rapid restoration of space assets and leveraging allied, foreign, and/or commercial space and nonspace capabilities to help perform the mission."[13] The United States will also consider TCBMs including "concepts for space arms control if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies."[14]

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[11] Ambassador Mahley, Donald A., "Remarks on the State of Space Security," The State of Space Security Workshop, Space Policy Institute, George Washington University, Washington, 1 Feb. 2008.

[12] Reaching Critical Will, "Preventing the Placement of Weapons in Outer Space: A Backgrounder on the draft treaty by Russia and China." 19 Aug. 2010 <http://www.reachingcriticalwill.org/legal/paros/wgroup/PAROS-PPWT-factsheet.pdf>.

[13] The White House. National Space Policy of the United States of America. Washington, D.C. 28 June 2010: 13. 19 Aug. 2010, <http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf>.

[14] The White House. National Space Policy of the United States of America. Washington, D.C. 28 June 2010: 7. 19 Aug. 2010 <http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf>.
Section 913 of the Fiscal Year 2009 National Defense Authorization Act (P.L. 110-417) directed the Secretary of Defense and Director of National Intelligence to submit a Space Posture Review to Congress by 1 December 2009. The Obama Administration issued Presidential Study Directives on space policy during its first months in office; See Klamper, Amy. "White House Orders Sweeping U.S. Space Policy Review," Space News, 15 July 2009, and Brinton, Turner. "International Cooperation Emphasis of

The new NSP takes a broader and more enthusiastic approach towards TCBMs and potential reliance on commercial and international partners than contained in the 2006 NSP language about opposing "development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space" while also encouraging "international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit."[15]

As space becomes an increasingly congested, competitive, and contested domain, the United States is likely to adapt to these changes by placing more emphasis on developing and enhancing appropriate norms of responsible behavior in space, becoming selectively interdependent with state-of-the-world commercial and international space capabilities, attempting to deny benefits from purposeful interference with space capabilities upon which the United States relies, and imposing costs for degrading or disrupting space capabilities.[16] In addition, the United States should assure implementation of its new space policy continues recent progress in supporting effective, sustainable, and cooperative approaches to space security. In particular, it should consider how to build on ongoing dialogue between major space actors in several venues that emphasizes incremental, pragmatic, and technical steps, moving in a bottom-up way from small measures toward larger activities. Prime examples of this approach include the February 2008 adoption by the United Nations General Assembly of the Inter-Agency Debris Committee (IADC) voluntary guidelines for mitigating space debris and the December 2008 Council of the European Union draft Code of Conduct for outer space activities.[17]

The Obama Administration's National Security Strategy released in May 2010 included helpful emphasis on space and several challenging objectives that will require significant effort:

» *Leverage and Grow our Space Capabilities*: For over 50 years, our space community has been a catalyst for innovation and a hallmark of U.S. technological leadership. Our space capabilities underpin global commerce and scientific advancements and bolster our national security strengths and those of our allies and partners. To promote security and stability in space, we will pursue activities consistent with the inherent right of self-defense, deepen cooperation with allies and friends, and work with all nations toward the responsible and peaceful use of space. To maintain the advantages afforded to the United States by space, we must also take several actions. We must continue to encourage cutting-edge space technology by investing in the people and industrial base that develops them. We will invest in the research and development of next-generation space technologies and capabilities that benefit our commercial, civil, scientific exploration, and national security communities, in order to maintain the viability of space for future generations. And we will promote a unified effort to strengthen our space industrial base and work with universities to encourage students to pursue space-related careers.[18]

These objectives are noteworthy and stand out even more considering this is the first National Security Strategy since the Clinton Administration that places such specific focus on space in this top-tier policy statement. Unfortunately, however, neither the National Security Strategy nor the NSP emphasize how these policy goals will be achieved; to ensure its policy goals are completely and consistently implemented the administration should put in place improved top-level management and organizational structures with clear lines of authority and responsibility as well as the durability needed to affect change.

Of course, since few of the agile and adaptive approaches discussed below are completely new and none are likely to provide a panacea, it is important to consider lessons from previous attempts to develop different approaches and apply best practices from across government, industry, and allies. In the evolving global security environment, the United States has few attractive traditional or unilateral options to sustain the asymmetric advantages space capabilities provide and it must proactively examine all prospects for greater effectiveness. In addition, given its current economic challenges, the United States must carefully consider every opportunity for greater efficiency while assuring effectiveness. Under recently announced

Forthcoming U.S. Space Policy," Space News, 21 May 2010.

[15] The White House. National Space Policy of the United States of America. Washington, D.C. 28 June 2010: 2. 19 Aug. 2010 <http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf>.

[16] Deputy Secretary of Defense Lynn III, William J. "Remarks at National Space Symposium," Colorado Springs, 14 April 2010.

[17] United Nations General Assembly. Resolution adopted by the United Nations General Assembly on 1 Feb. 2008. UN doc. A/RES/62/217 of 1 Feb. 2008. 19 Aug. 2010 <http://www.oosa.unvienna.org/pdf/gares/ARES_62_217E.pdf>; Council of the European Union, Council Conclusions and Draft Code of Conduct for Outer Space Activities. 17175/08 of 17 Dec. 2008. Brussels: European Union.

[18] Obama, Barack. National Security Strategy. Washington D.C. The White House. May 2010: 31.

plans for the U.S. Government to decrease spending significantly, including a $100 Billion cut over five years to the Department of Defense (DOD),[19] it is likely many current and future space programs will face increased scrutiny and austere funding.

As the global security environment evolves, the United States can strengthen its space leadership and offset potential adversary gains by improving relationships with allies and partners in the civil and commercial space sectors. It must also work harder and in more creative ways to assure the availability of commercial space services, particularly as it becomes increasingly reliant on commercial communications and remote sensing. Better dialogue between the NSS enterprise and commercial and international partners as well as consistent implementation of policy are keys to protecting and improving asymmetric space advantages. Wherever possible, the U.S. Government also should attempt to shape this sector through favorable licensing decisions or giving commercial benefits, such as long-term leases or priority in purchasing, to those companies doing the most to ensure protection of their services but keeping decisions about risk and market forces within the commercial sector. If successfully implemented the result could be a vastly increased space capability – a "SpaceCRAF" or a "1,000 spacecraft fleet"[20] – that augments national security space assets with efficient, reliable, on-demand capabilities. In order to achieve goals in its new space policy the United States should, in particular, develop more effective ways to leverage commercial and international capabilities including more strategic partnerships, outsourcing operations, improving export controls, and better international engagement.

Strategic Partnerships. The commercial marketplace is mature and efficient, especially with respect to satcom, growing more so in remote sensing and ground operations (satops). Closer government-commercial cooperation offers the potential for cost savings, greater availability of different space capabilities, more rapid throughput of information, service provider diversity and therefore improved mission assurance and technology risk reduction, as well as prospects for strengthening deterrence against attacks by increasing the number of actors that potential attackers must confront.

Insourcing or Outsourcing. There are several ways to use space for national security purposes. One is to outsource all functions, except perhaps the most existential like strategic (nuclear) communications, missile early warning or detection of nuclear detonations. The United Kingdom (UK) uses this outsourcing model for satcom; a commercial company, Paradigm, operates UK communications satellites.[21] Another approach would be to return to the 1970s and do all national security space functions in house, albeit at great costs. The United States must carefully consider all opportunities for cost savings by adopting leaner commercial satops models and leveraging "good enough," state-of-the-world capabilities, rather than building and operating dedicated capabilities wherever practical.

Export Controls. Unless resolved by Congress, which created the rules in the first place, U.S. export controls for space capabilities will continue to hamper U.S. companies' participation in the worldwide commercial space marketplace. Although significant questions remain concerning what space technologies the U.S. government wishes to protect and which it wishes to export, to a certain extent these issues have already been resolved in practice since many technologies on the Munitions List are already readily available worldwide. Satellite manufacturers around the world, large and small, private and governmental, are building satellites with similar capabilities and nearly as much reliability as U.S.-manufactured satellites. The United States needs to understand these state-of-the-world capabilities in order to better protect its state-of-the-art space technologies. And export controls need to be flexible enough to allow moving the line to protect emerging "exquisite" technologies while also allowing export of previously controlled technology that is transferred deliberately or accidentally and becomes "good enough." Understanding technology maturation rates is important because they will vary and not every technology will obey Moore's Law; for example, protected EHF communications may currently be state-of-the-art but will eventually become state-of-the-world. As recently emphasized by Secretary of Defense Robert Gates, the goal of export control reform should be "a system where higher walls are placed around fewer, more critical

[19] Hodge, Nathan. "Pentagon Looks to Save $100 Billion Over Five Years," Wall Street Journal, 4 June 2010.
[20] Cavas, Christopher P. "The Thousand-Ship Navy," Armed Forces Journal, 24 May 2010, 19 Aug. 2010 <http://www.afji.com/2006/12/2336959>.
CRAF stands for Civil Reserve Air Fleet.

[21] In October 2003, the UK Ministry of Defence signed the 3.6 million pound Skynet 5 contract with Paradigm. The company owns, manages, and operates the Skynet 5 system for the UK and also provides satcom services to NATO, the Netherlands, Portugal, Canada, France, and Germany.

items;"[22] otherwise, U.S. industry will remain at a grave disadvantage.

International Engagement. With the United States going it alone in space less frequently and relying more on partners, space capabilities become more resilient, more dispersed, and more easily replenished because they use state-of-the-world technology. State-of-the-art constellations also can be augmented with state-of-the-world capabilities to make these important capabilities more resilient. Additionally, state-of-the-world capabilities could be better integrated into U.S. capabilities than allied capabilities are today. The 40-plus nations taking part in NATO's International Security Assistance Force (ISAF) in Afghanistan are too often unaware of space capabilities available to them and also too often denied access to space-derived intelligence, according to the former chief of ISAF space operations: "Military satellites in Europe are designed for use only by the nation that owns the asset, or at best for bilateral use as part of an exchange agreement with another nation," this official said.[23]

Another advantage of improved cooperation at the state-of-the-world level is that it could complicate an adversary's targeting calculus. Why attack a Luxembourg-flagged satellite that carries U.S. military communications when such an attack could constitute an attack on NATO? Alliance dynamics can lead to lowest-common-denominator outcomes but more cooperation with allies and commercial partners at the very least means adversaries have more potential enemies to sort out. Since commercial satcom platforms typically support a host of international users as well as U.S. forces, the political costs and escalatory risks of carrying out destructive attacks on those assets might deter the opponent from such attacks unless the conflict escalated to a higher level.[24]

[22] Secretary of Defense Gates, Robert M. "Export Control Reform," Presentation to Business Executive for National Security, Washington, 20 April 2010.

[23] Benitez, Jorge. "US Officer: 'We Need a NATO Space Operations Control Center'," Space News, 9 May 2010. 21 May 2010 <http://www.acus.org/natosource/us-officer-we-need-nato-space-operations-control-center>.

[24] Morgan, Forrest E. "Deterrence and First-Strike Stability in Space: A Preliminary Assessment." Santa Monica (CA): RAND Corp., 2010: 16.

2.7 Space Security: Transatlantic Approach to Space Governance

by Jean-François Mayence

The concept of *space security*, although it has known a dramatic increase of interest these latest years, is not new. What is particularly remarkable is the way it has moved from a defense-related concern to a much broader issue involving political, economical or even ethical aspects at global level. This is also due to the fact that the concept of *space security* has several meanings. Indeed, it covers different issues which are interconnected.

Space security means at the same time:

- *outer space for security*: the use of space systems for security and defense purposes ;
- *security in outer space*: how to protect space assets and systems against natural and/or human threats or risks and to ensure a sustainable development of space activities ;
- *security from outer space*: how to protect human life and earth's environment against natural threats and risks from outer space.

Those several understandings make the subject quite vast. For the purpose of this paper, we will limit ourselves to the second understanding.

In their respective approach of the concerns related to space security at the international institutional level, the European Union and the United States of America have often had troubles to find a common ground.

While EU had difficulties to initiate concrete measures and actions seeking in the meantime for a multilateral solution, US gave priority to national policies, defining the standards of excellence and the *de facto* requirements, notably through its bilateral cooperation. This was particularly the case for the space debris issues, which illustrates the way to proceed with the 'multilateralization' of technical standards. The technical cooperation and coordination (through IADC[25]) was followed up by proposals from European countries to work on regulatory measures. Such proposal faced reluctance from the US and other big space faring nations.

This is where the evolution of the world space sector to the so-called privatization phase

[25] Inter-Agency Debris Committee.

<table>
<tr><td>2000</td><td colspan="3">European proposals for a Space Debris Item on the Agenda of UNCOPUOS Legal Sub-Committee</td></tr>
<tr><td>2007–2008</td><td colspan="3">adoption of ESA Space Situation Awareness Programme</td></tr>
<tr><td rowspan="4">2007</td><td rowspan="4">EU Response to:
• TCBM / UNCD Debate on Non-Militarization of Outer Space
• US National Space Policy (2006)
• Incidents in Outer Space (Iridium-Cosmos collision, etc.)
• (Chinese) Satellite Destruction Test</td><td>2008</td><td>Draft Code of Conduct (to be adopted 2010?)</td></tr>
<tr><td>2008</td><td>French Initiative on Long-Term Sustainability of Space Activities (LTSSA)</td></tr>
<tr><td>2010–2013</td><td>UNCOPUOS WG LTSSA</td></tr>
<tr><td>2010</td><td>European Commission-US Space Dialogue on Space Security</td></tr>
</table>

Table 2: Main milestones in the European approach of space security concerns

plays a determinant role. The public strategic vision of the space security thematic is now complemented with the global approach from the commercial stakeholders. Where States preferred to cope with the risk of having their satellite destroyed in a collision rather than sharing sensitive and strategic information with other States, commercial operators voice their main concern about protecting their asset. The risk is considered with regard to its economical value, so is any information allowing to mitigate it and thereby reducing its financial impact.

Apart from the global privatization phenomenon which has characterized space activities for 25 years now, another trend might play a role in the search for a multilateral approach of space security-related issues. The fact that more and more countries become directly involved and/or active in space activities, leading to the emergence of new big space faring nations and questioning the traditional balance between US and Russia, is certainly relevant. Adopting, imposing and implementing measures to mitigate the risks of space operations has a cost. Even if the main space nations (and their industry) have accepted so far to bear this cost through their national policies and regulations without imposing their security standards to smaller or emerging space powers, things might change in an environment where the space sector is now part of the global economy. Compliance and non-compliance with security standards may be seen in terms of competitiveness disruption and this is certainly the ultimate justification to seek for multilateral solutions.

The legal aspects of space security will definitely need to be assessed at short term. The question whether they should be translated either in soft law (code of conduct, guidelines, recommendations) or through new binding instruments is a secondary issue. Existing legal mechanisms may already provide a solution with regard to the consequences of the non-respect of international standards. For instance, the notion of *fault* featured in Article III of the 1972 Liability Convention still needs to be defined in order to determine whether the non-compliance with those standards give rise to a claim under the Liability Convention[26].

It seems that we are now at the point where the cost of doing nothing for the sake of space security is higher than the cost of adopting and implementing concrete measures. Given the expansion and the nature of space activities, the effectiveness of such measures requires concerted, integrated actions by all governments and actors worldwide. It takes only one small satellite to destroy another: the biggest threat doesn't come from big operators of satellite constellations, but from small uncontrolled satellites or cheaply designed spacecraft which would be exempted of compliance with international standards due to the lack of national (and international) regulations.

In conclusion, it is obvious that a EU-US bilateral approach is useful (although not sufficient) in order to lay down the basis for an international cooperation in space security. A first step could be to highlight what is already done, what is needed, what is possible and what is not (including solutions if any) in the sharing of information and the 'cooperative security'.

The private sector, in particular commercial operators, although rather absent from the discussion so far, has a determinant role to play in initiating a global system for the maintenance of the security of space operations.

[26] On this question, see: Jakhu, Ram S., "Iridium-Cosmos collision and its implications for space operations", ESPI Yearbook on Space Policy 2008-2009. Kai-Uwe Schrogl, e.a., eds. Vienna: ESPI: 254 and Mayence, Jean-François. "Granting Access to Outer Space: Rights and Responsibilities for States and their Citizens." (An alternative approach to Article VI of the Outer Space Treaty, notably through the Belgian space legislation.) To be published by University of Nebraska, under the direction of Prof. Dr. Frans von der Dunk.

2.8 Building a Cooperative Space Security Framework
by Joshua T. Hartman

There is increasing interest in establishing international norms and best practices to ensure the use of space for generations to come. Discussions that would eventually lead to an agreement can only occur when genuine interests align and a perception of resolve is established by and across multiple stakeholders. The future of space security rests on this occurring. Unfortunately to date, many key stakeholders in space have largely talked pass each other rather than to each other. Moreover, space security has often been a pawn for larger political interests. In reality, little alignment has occurred and resolve seems nonexistent at this point, but opportunities exist. Principal nations could together take steps toward achieving alignment, establishing international resolve, and providing global leadership in space security.

Towards this end, U.S. and Europe offer potential for progress between principal stakeholders. The U.S. and Europe have a long history of cooperation. For many decades, security has linked the two. Space security provides a new opportunity to combine common interests. However, the current relationship in this area is not strong enough to build a strong cooperative for space security. Unfortunately, activities by other space actors have only provided for divisive distractions. Before progress can be realized, improvements in the relationship must be made and a common understanding developed. Parties interested in establishing transatlantic partnership must create a framework and pursue a series of basic Transparency and Confidence-Building Measures (TCBM) between the two principal stakeholders.

For context, the 1984 Conference on Disarmament proposed, what later was approved by the General Assembly in UNGA Res. 43/78H, guidelines for confidence-building measures. These guidelines suggested that:

- Confidence-building measures must neither be a substitute nor a precondition for disarmament measures nor diver attention from them;
- Confidence-building measures may be worked out and implemented independently in order to contribute to the creation of favorable conditions for the adoption of additional disarmament measures
- The implementation of confidence-building measures should take place in such a manner as to ensure the right of each State to undiminished security, guaranteeing that no individual state or group of states obtains advantages over others at any stage of the confidence-building process

Applying these guidelines on TCBMs to space security, I offer U.S. and European policy makers a simple framework on which to move forward.

> Define the desired end and link the measures to that end.

Not every TCBM is equal. While general confidence and transparency must exist for a successful long-term relationship and eventual agreement, the absence of open discussions referencing specific ends will produce few substantive results. Until states can either unilaterally or collectively articulate the focus for TCBMs, any action will likely be misdirected and of limited value. The areas of possible consensus must be indentified and specific objectives and measures established. Objectives and measures should be broken into sub-objectives and sub-measures until they exist at the most basic and simple level. The ends may be stated in terms of achievement or avoidance. Clear linkage through multiple levels will contribute to true transparency. The exercise of defining objectives at a sublevel and linking to specific ends will develop clear understanding and perspectives from all of the interested parties. In the context of Space Security, there has neither been formal policy declaration by a stakeholder of positioning kinetic weapons in space nor has their been any qualifiable production or deployment of weapons designed specifically for space. Given this, some argue the sense of urgency is less than typical in arms discussions and, therefore, focus should be on prevention rather than control. Possible places for the U.S. and Europe to start include:

- Considering kinetic destruction or disruption in space or from space.
- Considering non-kinetic destruction or disruption in or from space.
- Consideration of non-malicious, but irresponsible actions – debris mitigation, unintended Radio Frequency disturbance.

> Building confidence is a process.

The ultimate goal of TBCM pursuit is to eliminate mistrust rather than complete the process a quickly as possible. This can be emphasized, as mentioned above, with a focus on prevention rather than control. As such, TCBMs should start small in expectation and move in an iterative manner towards the ends defined above. Pushing other parties too far too fast will make those parties suspicious of the process and eventually disenfranchised with the results. Likewise the significance of unilateral moves toward intended confidence measures should not be underestimated or go unrewarded. TCBMs should be seen truly as building blocks in a long-term relationship.

Employ a long-term framework focused on: 1) Transparency, 2) Coordination, and 3) Accountability. Start by focusing on transparency: data sharing measures; greater scientific dialogue; discussion of plans and programs; familiarization visits. When a solid foundation towards transparency has been established, move to discussions on coordination within existing bodies: e.g. ITU, WMO, IADC, and Launch Registration. Once the first round of discussions on coordination activities has been completed, determine the remaining gaps and needs followed with ways to address them.

Refrain from accountability discussions, until after coordination measures have been firmly in place and fully accepted. All parties must be open to accountability discussions before productivity in this effort can occur. This will require confidence in the level and type of transparency achieved as well as comfort in coordination efforts accomplished. Accountability should transition from informal to formal measures. It is critical that formal accountability not come at the cost of transparency and confidence measures successfully established.

Measures must be focused on creating favorable conditions.

Favorable conditions may be measured as any improvement above the current standard. Hope for grand progress should not prevent small improvements. Especially in the early stages of discussions, establishing a conducive environment should be a primary goal, regardless of the substance of issues discussed.

Throughout the discussion and negotiation process, stakeholders should be expected to maintain their security interests. Appropriate allowances must be made for this. TCBMs must be a win-win for the U.S and Europe (with consideration to the rest of the global community) to be successful. A common denominator approach, one that seeks and focuses on the most agreeable overlaps of mutual interest, will forge sustainable progress; anything else during multi-lateral discussions will be seen as uneven and potentially disingenuine. Greater advancement will occur if discussions on perceived asymmetries are generally avoided; these discussions should occur only on topics which parties lack sensitivities or the asymmetry provides a clear opportunity to or benefit in leverage and protection of complementary capabilities. As an example, many observers in the U.S. informally see the proposed Russian-China Space Arms treaty as political theater with neither serious intentions nor beneficial potential. As such, attempting push the U.S. into discussion with it as a basis is not recommended.

The Nuclear model and rhetoric does not work for development of Space measures.

The language in UN Res 43/78H was agreed to during the one of the largest defense (and nuclear) build-ups of the Cold-war. It is "Disarmament" focused and therefore not constructive to space in as much as today's policy efforts are not intended to disarm, rather to prevent or control armament as it may happen.

While some countries may believe they are in an arms race, the prevailing U.S. perspective is that is not the case for today's space security environment. While merely a matter of rhetoric to some, many in the U.S. take exception to the description and see it as an unfair and inaccurate exclusion of U.S. activities and intentions, creating a reluctance to engage. Using a program focused on prevention rather than control will help eliminate old perspectives.

Disarmament and Arms Race contain largely nuclear connotations. The nuclear analogy is not an accurate or useful representation of the current or potential environment regarding space. It serves only to distort realities, heighten emotions, an increase tensions. Finding a different model would be a much more productive measure.

In conclusion, as the momentum grows toward the establishment of cooperative space security, ultimately its achievement mandates transparency and confidence between the key stakeholders. The U.S. and Europe have the common bonds and interests to begin that effort, and in the process provide global leadership. Often simplicity leads to the best results; using existing United Nations guidelines will develop a basic framework to establish TCBMs. This will lead to future and lasting agreements. Yet, stakeholders must pursue them in the manner intended: to methodically build confidence. That will require a new approach from those used in the past, built around the same basic constructs, but applied specifically to space and today's geopolitical environment.

List of Acronyms

AGI	Analytical Graphics Inc.
ASAT	Anti-Satellite
BWC	Biological Weapons Convention
CD	Conference on Disarmament
CFE	Conventional Forces of Europe
CODUN	Council Working Group on Global Disarmament and Arms Control
CRAF	Civil Reserve Air Fleet
CWC	Chemical Weapons Convention
DOD	Department of Defense
EC	European Commission
ECSS	European Centre for Space Standardisation
EDA	European Defence Agency
EOS	Earth Observation Satellite
ESA	European Space Agency
ESP	European Space Policy
EU	European Union
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
GSO	Geostationary Orbit
HCOC	Hague Code of Conduct against Ballistic Missile Proliferation
IADC	Inter-Agency Space Debris Coordination Committee
IAEA	International Atomic Energy Agency
ICC	Immediate Central Contact
ICOC	International Code of Conduct against Missile Proliferation
INF	Intermediate Range Nuclear Forces
IR	Infrared
IRS	Indian Remote Sensing Satellite
ISAF	International Security Assistance Force
ISMA	International Satellite Monitoring Agency
ITU	International Telecommunications Union
LEO	Low Earth Orbit
LTBT	Limited Test Ban Treaty
LTSSA	Long-Term Sustainability of Space Activities
MAD	Mutually Assured Destruction
MIT	Massachusetts Institute of Technology
MODIS	Moderate Resolution Imaging Spectroradiometer

MTCR	Missile Technology Control Regime
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organisation
NEO	Near Earth Object
NIRATAM	NATO Infrared Target Model
NPT	Non-Proliferation Treaty
NSP	National Space Policy
NSS	National Security Space
NTM	National Technical Means
OST	Outer Space Treaty
PAROS	Prevention of an Arms Race in Outer Space
PLNs	Pre-Launch Notifications
PPWT	Draft Treaty on the Prevention of Weapons in Outer Space and the Threat of Force Against Outer Space Objects
PTBP	Partial Test Ban Treaty
Res.	Resolution
SATCOM	Satellite Communications
SATOPS	Satellite Operations
SDA	Space Data Association
SEVIRI	Spinning Enhanced Visible and Infrared Imager
SLVs	Space-Launch Vehicles
SPOT	Satellite Pour l'Observation de la Terre
SPR	Space Posture Review
SSA	Space Situational Awareness
START	Strategic Arms Reduction Treaty
STM	Space Traffic Management
TCBMs	Transparency and Confidence-Building Measures
TLE	Two-Line Element
US	United States
UHF	Ultra High Frequency
UK	United Kingdom
UN	United Nations
UNCOPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UNGA	United Nations General Assembly
UNOOSA	United Nations Office for Outer Space Activities
US STRATCOM	US Strategic Command
USC	United States Code
USSR	Union of Soviet Socialist Republics
WMD	Weapons of Mass Destruction
WMO	World Meteorological Organisation

Conference Programme

May 6:
Transparency and Confidence Building Measures: Alternative Vehicles to Advance Space Security

The first day of the conference, co-organized by the European Space Policy Institute (ESPI) and the College of Law, University of Nebraska, will be dedicated to challenges associated with the adoption of Transparency and Confidence-Building Measures (TCBM) in space and the rationale for such measures.

From a geopolitical perspective, Europe generally favors inclusive, preemptive diplomacy. This, in part, involves providing potential competitors with concrete incentives to protect safe access to, and use of, space. In the U.S., the Obama Administration has demonstrated its affinity for multilateralism and engagement as hallmarks of the President's foreign and security policy portfolio. History provides ample evidence that TCBMs have the best prospects for success when they are initiated and led by countries whose national policies largely coincide with the various multilateral objectives .

The conference panels will discuss how terrestrial TCBMs can serve as a guide to understanding better the politically possible in space, including useful precedents. The proceedings will seek to determine where consensus can be achieved, what bottlenecks exist, as well as where and how past agreements were undermined by differing objectives and modalities. A principal goal will be to identify the most effective ways to strengthen space security. These and other issues will be evaluated by our invited speakers and panelists, prominent government officials, ESA representatives, and distinguished academics from Europe and the U.S.

May 7:
Space Tourism: Perspectives on Licensing and Governance of Operators, Spaceports, and Export Controls

The second day of the conference will focus on Transatlantic perspectives on licensing and governing private operators of commercial manned spaceflights and commercial spaceports, as well as export controls issues as they might affect impending space tourism.

Currently, the U.S. is the only state in the world that has developed national legislation specifically dealing with commercial manned spaceflights, focusing on such issues as passenger liability and informed consent by passengers. Whilst this specific legislation is essentially of an interim nature, it applies in conjunction with more permanent and general legislation on commercial spaceflight such as the Commercial Space Launch Act providing inter alia for a licensing regime and third-party liability arrangements. In Europe, so far a handful of states have adopted national framework laws for licensing private space operators, without however specifically addressing space tourism. In Sweden, for example, the current approach is to follow U.S. developments in this regard.

The conference will discuss to what extent the potential for a global space tourism and commercial manned spaceflight industry would require an international regime, based on the international space treaties and, perhaps, the U.S. national law developments. An important distinction which may be addressed in this context concerns that between licensing commercial spaceflight operators and operators of spaceports. In addition, with a view to Europe the possible roles of ICAO and the European Aviation Safety Administration will be discussed, as it illustrates broader tendencies to align any future regime for commercial manned spaceflight with existing aviation regimes. Finally, an international framework in this context would also have to address appropriately the issues arising from export control regimes.

April 2010

ESPI
European Space Policy Institute

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SPACE SECURITY AND SPACE TOURISM: CHALLENGES TO, AND TRANSATLANTIC PERSPECTIVES ON, GOVERNANCE

Conference Sponsored by the University of Nebraska Space and Telecom Law Program and the European Space Policy Institute

May 6-7, 2010

Lincoln, NE

UNL College of Law (Room 109)

Agenda: Draft of 14 April

May 6: Transparency and Confidence Building Measures: Alternative Vehicles to Advance Space Security

8:00 - 8:45	Coffee and Registration
8:45	Welcome Remarks: **Matthew Schaefer & Kai-Uwe Schrogl**
9:00-9:45	Keynote Remarks: "Arms Control, Transparency & Confidence Building" **Ambassador Richard Butler,** former Executive Chairman of the UN Special Commission to Disarm Iraq (UNSCOM)
9:45-10:00	Break
10:00 – 11:15	**Panel I: Transparency and Confidence-Building Measures (TCBM): Common Ground and Future Challenges** Chair: **Matthew Schaefer,** Director of Space and Telecom Law Program, College of Law, University of Nebraska
Panelists:	**Richard H. Buenneke,** Deputy Director, Office of the Missile Defense and Space Policy, Bureau of International Security and Nonproliferation, U.S. Department of State **Erwin Duhamel,** Head of Strategic Security and Partnership Development Office, European Space Agency (ESA) **Lt. Col. Brandon Hart,** Chief of Cyber and Space Law, USSTRATCOM
11:15-11:30	Break
11:30 – 12:55	**Panel II: Terrestrial TCBM Check List: Non-Proliferation and Arms Control** Chair: **Matthew Schaefer,** Director of Space and Telecom Law Program, College of Law, University of Nebraska
Panelists:	**Bhupendra Jasani,** Professor, Department of War Studies, King's College London **Richard L. Williamson,** Professor of Law, University of Miami (FL) **Louis Haeck,** Adjunct Professor, Royal Military College of Canada
13:00 – 14:00	Lunch
14:10 – 15:35	**Panel III: Space Behaviour: Proposed Mechanisms for Enhanced Space Security** Chair: **Kai-Uwe Schrogl,** Director, European Space Policy Institute (ESPI)
Panelists:	**Kenneth Hodgkins,** Director, Office of Space and Advanced Technology, U.S. State Department **Jana Robinson,** Resident Fellow, European Space Policy Institute (ESPI) **Darren Huskisson,** former Chief Cyber and Space Law, USSTRATCOM
15:35-15:45	Break
15:45 – 17:15	**Panel IV: Future Cooperative Security Architecture in Space** Chair: **Kai-Uwe Schrogl,** Director, European Space Policy Institute (ESPI)
Panelists:	**Peter L. Hays,** Associate Director, the Eisenhower Center for Space and Defense Studies **Jean Francois Mayence,** Head of Legal Unit International Relations, Belgian Federal Office for Science Policy **Joshua T. Hartman,** The Center for Strategic and International Studies
17:15 – 17:30	Closing Remarks/Adjourn/Buses Back to Van-Brundt Visitors Center
18:00	Cocktails/Dinner Van Brundt Visitors Center

May 7: Space Tourism: Perspectives on Licensing and Governance of Operators, Spaceports, and Export Controls

8:00-8:45AM	Coffee & Registration
8:45	Welcome Matthew Schaefer & Kai-Uwe Schrogl
9:00-9:45	**Keynote** TBD
10:00-11:25	**Panel I: Space Tourism: Licensing of Spaceports** **Laura Montgomery,** Senior Attorney, FAA-AST **Steve Landeene,** Executive Director, Spaceport America **Ben Droste,** SpaceEXperience Curacao **Frans Von Der Dunk,** Professor, UNL College of Law
11:30-12:30	Lunch
12:40-14:00	**Panel II: Space Tourism: Licensing of Operators** **Laura Montgomery,** Senior Attorney, FAA-AST **Marc Holzapfel,** Senior Legal Council, Virgin Galactic **Michael Gerhard,** EASA **Erwin Duhamel,** Head of Strategic Security and Partnership, Development Office, European Space Agency
14:00-14:30	Break
14:30-15:30	Keynote Remarks: "Key Elements of Future Space Security" **Gen. Kevin P. Chilton,** Commander, U.S. Strategic Command, Offutt Air Force, Nebraska
15:30-15:45	Break
15:45-17:00	**Panel III: Security Issues of Private Commercial Space Flight: ITAR & the EU Regime** **Dennis Burnett,** VP, EADS-North America **Mike Gold,** Washington, DC Director, Bigelow **TBD:** Additional European Perspective
17:30	Cocktails/Dinner (UNL Law College Reading Room)

About the Contributors

Erwin Duhamel

Erwin Duhamel works in the European Space Agency (ESA) as the Head, Security Strategy and Partnership Development Office in the Director Generals Policy Office. He is responsible for the development and implementation of the security strategy in the Agency since September 2007. Before that he was the head of the Belgian Defence Space Office and chairman of different NATO and EDA committees concerning space. The security strategy office is responsible for the development of the Agency's security policy and related preparatory, promotion and coordination actions, managing the relevant studies, as well as of the elaboration of an overall partnership development strategy based on the elaboration of partnership models and promotion of their implementation. Currently the main activities are: GIANUS (Global Integrated Network for iNovative Utilisation of space for Security), Space situation awareness, space based hyperspectral, SATCOM, Telemedecin, etc.

Peter L. Hays

Peter L. Hays works for SAIC supporting the Department of Defense and the Eisenhower Center, and teaches at George Washington University. He helps develop space policy initiatives including the National Defense University Spacepower Theory Study. Dr Hays holds a Ph.D. from the Fletcher School and was an honor graduate of the USAF Academy. He served internships at the White House Office of Science and Technology Policy and National Space Council and taught space policy courses at the USAF Academy, School of Advanced Airpower Studies, and National Defense University. Major publications include: *Spacepower for a New Millennium*; "Going Boldly—Where?" and *United States Military Space*.

Brandon Hart

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Joshua T. Hartman

Joshua T. Hartman is a senior associate with the Center for Strategic and International Studies (CSIS). His career has focused on development and execution of strategy and programs covering missile defense, cyberspace, intelligence, and space. Previously, he was senior adviser to the under secretary of defense for acquisition, technology and logistics (USD(AT&L)) and director of the Space and Intelligence Capabilities Office (SIO). As senior adviser, he was responsible for supporting the USD(AT&L) in matters relating to the acquisition system at the Department of Defense (DOD), including research and development, advanced technology, test and evaluation, production, and logistics, to include end-to-end systems delivery of technology to the warfighter.

Mr. Hartman began his career as an officer in the U.S. Air Force. His assignments included the Space and Missiles Systems Center, National Reconnaissance Office, Joint Chiefs of Staff, Office of the Secretary of Defense, and Naval Research Laboratory. He joined the House Armed Services Committee as a professional staff member in 2004 to develop policy regarding U.S. government involvement in cyber operations, space, intelligence, defense acquisition, and missile defense. He then joined the House Appropriations Committee to perform oversight, create and facilitate execution of the DOD budget, and develop national security policy and investment strategy regarding cyber, space, and intelligence. During that time, he became staff director of the Select Intelligence Appropriations Panel, where he provided oversight for all components of the intelligence community while managing the resources and developing and implementing the legislative strategy for reforming that community. In recognition of his service, he has received numerous military awards, was selected by Space News as one of the top 10 individuals in 2006 "making a difference" in space around the world, and was awarded the Secretary of Defense Outstanding Public Service Award. He attended the U.S. Air Force Academy, graduating with a B.S. in astrophysics. He earned an M.S. with honors in strategic intelligence, with a concentration in Middle East/Iranian affairs, from the National Defense Intelligence College. He also completed work in the Graduate Program of Business Administration at California State University, Long Beach. He continues to serve as a member of the Air Force Reserves.

Kenneth Hodgkins

Kenneth Hodgkins has been with the Department of State since 1987 and presently is the Director for the Office of Space and Advanced Technology in the Bureau of Oceans, Environment and Science. The office is responsible for bilateral and multilateral cooperation in civil and commercial space and high technology activities, including the International Space Station, collaboration in global navigation satellite systems, the International Thermonuclear Experimental Reactor (ITER), and nanotechnology, and represents the Department in national space policy review and development. Mr. Hodgkins serves as the U.S. Representative to the UN Committee on the Peaceful Uses of Outer Space (COPUOS). He has been the State representative for major Presidential policy reviews on remote sensing, the Global Positioning Satellite (GPS) system, orbital debris, and the use of space nuclear power sources in space. Before coming to the State Department, he was the Director for International Affairs at the National Environmental Satellite Data and Information Service (NESDIS) of the Department of Commerce. He joined NOAA/NESDIS in 1980. He is the 2010 recipient of the AIAA International Cooperation Award and was named by *GPS World* as a “GNSS Leader to Watch in 2009-2010.”

Bhupendra Jasani

Bhupendra Jasani joined the Department of War Studies in 1990. He heads a programme on military uses of outer space and arms control verification, monitoring peace agreements and confidence-building measures from space as well as issues related to nuclear, chemical and space weapons. He has an MSc in nuclear physics and a PhD in nuclear physics and nuclear medicine. Between 1958 and 1972, he worked for the British Medical Research Council and then joined the Stockholm International Peace Research Institute (SIPRI) in Sweden in February 1972 before joining the Royal United Services Institute for Defence Studies, London, as a Rockwell International Fellow, in October 1987.

Jean-François Mayence

Jean-François Mayence is the Head of the Legal Unit “International Relations” at the Belgian Federal Office for Science Policy. He is in charge of legal aspects of international cooperation programme in various fields, including space research & applications, but also Antarctica, generic sciences, human sciences, etc. In that capacity, he was member of the Belgian Delegation to ESA for 9 years. He’s a member of the Belgian Delegation to UNCOPUOS since 1999. He likewise lectures at University of Leuven, teaching legal aspects of space activities.

Jana Robinson

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. Ms. Robinson is currently pursuing her PhD at Charles University in Prague focusing on global 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 and space security issues, 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), the 2008 Summer Mandarin Training Course at the Mandarin Training Center of the National Taiwan Normal University in Taipei, and a one-year study program at Shanghai University in 1999–2000.

Matthew P. Schaefer

Matthew P. Schaefer is the Law Alumni Professor of Law, and Director of the Space and Telecom Law Program at the University of Nebraska College of Law. Professor Schaefer teaches Public International Law, International Trade Law, International Business Transactions, and International Trade Law and Policy Seminar. In February 2006, Professor Schaefer was named inaugural Director of the USA's first degree-bearing Space and Telecommunications Law Program. He was integrally involved in gaining University and external approval for the LLM degree, developing the curriculum, hiring faculty for the program, organizing conferences, and administering a $1.71 million NASA grant. Professor Schaefer is a graduate of the University of Chicago (B.A.) and the University of Michigan Law School (J.D. magna cum laude, Order of the Coif, L.L.M. in international law). During his law studies, he received the William W. Bishop, Jr. Award for performance with distinction in the field of international law and also served an externship at the U.S. State Department-Office of the Legal Advisor. He studied at the Australian National University in Canberra, Australia under a Ford Foundation Fellowship. Professor Schaefer is a former term-member of the Council on Foreign Relations and also a member of the Council on Foreign Relations Academic Outreach Advisory Board. He serves on the board of editors of the Journal of International Economic Law, and also serves on the advisory board of the Canada-U.S. Law Institute. During the 1999 calendar year, Professor Schaefer served as a director in the International Economic Affairs Office of the National Security Council (NSC). He was the principal staff member responsible for the formulation, coordination and implementation of U.S. foreign policy as it relates to international economic issues. In his role as a director, he prepared senior NSC officials for meetings with the President and foreign dignitaries and assisted in the development of international trade policy recommendations. Prior to joining the faculty, Professor Schaefer served as an international trade consultant to the National Governors' Association and Western Governors' Association in Washington, D.C. during the legislative implementation of the North American Free Trade Agreement (NAFTA) and GATT Uruguay Round multilateral trade agreement. He has also served as a consultant to two members of the European Parliament in Brussels, Belgium and the states of Hawaii, Texas, and Utah.

Kai-Uwe Schrogl

Kai-Uwe Schrogl is Director of the European Space Policy Institute (ESPI) in Vienna, Austria since 2007. Before, he was Head of Corporate Development and External Relations Department in the German Aerospace Center (DLR). In his previous career he worked with the German Ministry for Post and Telecommunications and the German Space Agency (DARA). He has been delegate to numerous international forums and recently served as the chairman of various European and global committees (ESA International Relations Committee, UNCOPUOS working groups). Kai-Uwe Schrogl has published nine books and more than 100 articles, reports and papers in the fields of space policy and law as well as telecommunications policy. He is editor of the "Yearbook on Space Policy" and the book series "Studies in Space Policy" both published at SpringerWienNewYork as well as member in editorial boards of international journals in the field of space policy and law (Acta Astronautica, Space Policy, Zeitschrift für Luft- und Weltraumrecht, Studies in Space Law/Nijhoff). Kai-Uwe Schrogl is Member of the Board of Directors of the International Institute of Space Law, Member of the International Academy of Astronautics (chairing its Commission on policy, economics and law) and the Russian Academy for Cosmonautics. He holds a doctorate degree in political science, lectures international relations at Tübingen University, Germany (as a Honorarprofessor) and has been a regular guest lecturer i.a. at the International Space University and the Summer Courses of the European Centre for Space Law.

Frans G. von der Dunk

Frans G. von der Dunk holds the Harvey and Susan Perlman Alumni / Othmer Chair of Space Law at the University of Nebraska-Lincoln's LL.M. Programme on Space and Telecommunication Law since January 2008. He also is Director of Black Holes BV, Consultancy in space law and policy, based in Leiden. Previously, he was Co-Director, then Director of Space Law Research at the International Institute of Air and Space Law at Leiden University since 1990. Prof. Von der Dunk was awarded the Distinguished Service Award of the International Institute of Space Law (IISL) of the International Astronautical Federation (IAF) in Vancouver, in October 2004, and the Social Science Award of the International Academy of Astronautics (IAA) in Valencia, in October 2006. In the summer of 2008, he was nominated, as the first lawyer ever, Member of the European Space Sciences Committee (ESSC) of the European Space Foundation (ESF). Also, he was the sole lawyer on the Panel on Asteroid Threat Mitigation established by the Association of Space Explorers (ASE) in 2007. He defended his dissertation on "Private Enterprise and Public Interest in the European 'Spacescape'" in 1998. He has written well over 120 articles and published papers, has given more than 100 presentations at international meetings and was visiting professor at some 25 foreign universities across the world on subjects of international and national space law and policy, international air law and public international law. He has co-organised some 20 international symposia, workshops and other events, and has been (co-)editor of a number of publications and proceedings. As of 2006, he is the Series Editor of 'Studies in Space Law', published by Brill. In addition, he has given a range of interviews to the international media on issues of space law and policy. Prof. Von der Dunk has served as adviser to the Dutch Government, several foreign Governments, the European Commission, the European Space Agency (ESA), the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD), the Dutch National Aerospace Agency (NIVR), the Japanese Space Exploration Agency (JAXA), the German Space Agency (DLR), the Brazilian Space Agency (AEB), the Swedish Space Corporation (SSC) and the Centre for Strategic and International Studies (CSIS), as well as a number of companies. Such advisory work dealt with a broad area of issues related to space activities, such as space policy, international cooperation in space, national space law, privatisation of space activities, Global Navigation Satellite Systems (GNSS) (in particular Galileo), satellite communications, radio astronomy, and earth observation. Also, he has acted as the Legal Task Manager in a number of studies undertaken in particular within the context of leading European Commission projects, such as on European space policy, Galileo and GNSS, satellite communications, the Global Monitoring for the Environment and Security (GMES) project and earth observation. Much of his recent work furthermore focused on such topical issues as space tourism, the legal status of the Moon and other celestial bodies and the 'sale-of- lunar-estate hoax', and planetary protection. He is Director Public Relations of the International Institute of Space Law (IISL), Member of the Board of the European Centre for Space Law (ECSL), and Member for the Netherlands in the International Law Association's (ILA) Committee on Space Law. He is also Member of the International Editorial Board of 'Space Policy'. Further memberships include: International Academy of Astronautics (IAA), American Branch of the International Law Association (ABILA), International Bar Association's (IBA) Section on Business Law (SBL), Committee Z on Outer Space Law, International Policy Advisory Committee (IPAC) of the International Society of Photogrammetry and Remote Sensing (ISPRS), American Institute of Aeronautics and Astronautics (AIAA; Senior Member), and Centro de Investigacion y Difusion Aeronautico-Espacial (CIDA-E; Corresponding Member).

Richard L. Williamson, Jr

Richard L. Williamson, Jr., Professor of Law, earned an A.B. in 1967 from the University of Southern California, an M.A. in 1977 from American University, and a J.D. in 1984 from Harvard Law School. Professor Williamson has served as a foreign service officer, as counselor and executive director of the American Foreign Service Association, and as division chief of the U.S. Arms Control and Disarmament Agency. Prior to coming to UM Law, he was an attorney with the law firm of Cleary, Gottlieb, Steen & Hamilton. He was Associate Dean from 1997-2000, and was on leave in 2000-2001 under a Fulbright grant to teach law in Leipzig, Germany. For two years, he was Interim Chair of the Department of International Studies in the Colleg of Arts and Sciences. Professor Williamson teaches introductory and advanced courses in environmental law, alternative dispute resolution, and courses and seminars on international law topics, including public international law, arms control and international environmental law. Professor Williamson is the Chair of the Faculty Senate.

Speakers of the First Day of a Space Security Conference in Lincoln, Nebraska (from right): Dr. Peter L. Hays, Darren Huskisson, Lt.Col. Brandon Hart, Prof. Richard L. Williamson Jr., Jean François Mayence, Jana Robinson, Louis Haeck, Prof. Bhupendra Jasani, Joshua T. Hartman, Amb. Richard Butler, Kenneth Hodgkins, Prof. Matthew Schaefer and Prof. Dr. Kai-Uwe Schrogl

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.

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