Conference on Disarmament

13 July 2010

Original: English

Letter dated 9 July 2010 from the Permanent Mission of Canada to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the report of a conference organized by UNIDIR entitled "Space security 2010: From foundations to negotiations" held from 29 to 30 March in Geneva

The permanent Mission of Canada to the United Nations presents its compliments to the Conference on Disarmament and has the honour to forward to you, on behalf of the United Nations Institute for Disarmament Research (UNIDIR), "Space Security 2010: From Foundations to Negotiations". The conference took place on 29 and 30 March 2010 and is the ninth annual conference in a series held by UNIDIR on the issue of space security, the peaceful uses of outer space and the prevention of an arms race in outer space (PAROS).

We would be grateful in this report could be issued as an official document of the Conference on Disarmament and distributed to all Member States to the Conference as well as to Observer States participating in the Conference.

Ambassador
Permanent Representative of Canada
to the Conference on Disarmament
(Signed): Marius **Grinius**

Space Security 2010: From Foundations to Negotiations

1. "Space Security 2010: From Foundations to Negotiations" is the ninth annual conference in a series held by the United Nations Institute for Disarmament Research (UNIDIR) on the issue of space security, the peaceful uses of outer space and the prevention of an arms race in outer space (PAROS).

2. The purpose of this conference series, in line with UNIDIR's mandate, is to promote informed participation by all states in disarmament efforts and to assist delegations to the Conference on Disarmament (CD) in preparation for possible substantive discussions on PAROS. Since the first conference was held in 2002, this series has received financial and material support from a number of Member States, foundations and non-governmental organizations, demonstrating the broad political support for these discussions.

3. This year's conference sought to continue the legacy of the eight conferences that preceded it in broadening and deepening the debate on PAROS and in fostering space security for the future. There is a growing global appreciation of the importance of space-based assets to human security, and thus increasing concern about the need to protect the space environment from disasters and conflict. This year's conference reflected this new urgency, aiming to provide a strong foundation of knowledge on space security issues in order to better inform and facilitate negotiations on PAROS and on broader questions of space security. The conference was comprised of three main sessions:

(a) the unique characteristics of space;

(b) latest developments in space security; and

(c) negotiations of space security—lessons, models and directions.

4. The conference convened in Geneva, Switzerland, at the Palais des Nations on 29-30 March 2010. The meeting was organized by UNIDIR with the assistance of Secure World Foundation and was supported financially and materially by the Governments of the People's Republic of China and the Russian Federation, as well as by Secure World Foundation and The Simons Foundation. Conference participants included UN Member States, UN Observers, non-governmental organizations, and civil society from all over the world. The following is a report of the conference.

Opening Remarks

Mr. Sergei Ordzhonikidze, Director-General of the United Nations Office at Geneva

5. The conference was opened with remarks from Mr. Sergei Ordzhonikidze. He noted that the conference agenda captured the multifaceted nature of the space security challenge. Though challenging, the importance of ensuring space security cannot be overemphasized as it is the only global commons that borders every state, and it provides potential for technological advancement, economic prosperity and strategic stability. Space-based assets are critical to national and international infrastructure: they support our communications, medical and public services, police forces and militaries. The United Nations has been at the heart of efforts to build an effective governance structure for space, especially through the Committee on the Peaceful Uses of Outer Space (COPUOS). Additionally, the UN community actively harnesses the powerful potential of space by utilizing it to achieve its development, peace- and security-building missions. For example, satellite imagery is routinely used to monitor natural resources, agriculture and climate change, and to facilitate

disaster-relief and peacekeeping efforts for both developed and developing countries. Most recently, satellite imagery proved essential in supporting disaster-relief services in Haiti after the earthquake of January 2010. It is Mr. Ordzhonikidze's hope that the United Nations will continue to lead the effort in guaranteeing the peaceful and optimal use of outer space for the future.

6. As the peaceful uses of outer space increase, so does their importance to people around the world. And as the world grows increasingly dependent on space, it becomes ever more critical to determine the nature and direction of space security and how best to balance the demands of civil, commercial and military uses of outer space. The increase of space debris and the development of space-related weapon technology threaten space security and increase the likelihood of space becoming a more hostile environment. States must appreciate their shared vulnerability in outer space and understand the mutual benefits of guaranteeing peaceful access to space for all the world's peoples. If not appreciated and understood, stability in space, and thus space-based assets, would be seriously threatened. International law does not prohibit the placement of conventional weapons in outer space. However, deploying such weapons in outer space would inevitably set off a new arms race. The CD is charged to prevent such an arms race in space. When this conference convened in 2009, the CD had just approved a new programme of work. Regrettably, this did not lead to progress. As yet, there is still no programme of work for this year's CD session, which continues to impede substantive work and progress in ensuring space security. Mr. Ordzhonikidze called on CD members to continue working in the spirit of compromise that allowed a programme of work in 2009 in order to achieve these important goals. While the foundations are there, effort needs to be made to move further in the direction of negotiations. The recent bilateral agreement between the Russian Federation and the United States of America to reduce their nuclear stockpiles should be taken as a signal of the growing political will to extend disarmament. Mr. Ordzhonikidze expressed the need to capitalize on this to strengthen norms, institutions and legal regimes concerning space security to demonstrate that the international community takes seriously this shared responsibility.

Session One

The Unique Characteristics of Space

7. Mr. Luca del Monte, Strategy Officer in the Space Security Office of the European Space Agency, began this session with an overview of the basic technical knowledge necessary for understanding the unique environment of space and its security. His briefing addressed orbital mechanics, space safety and security, and space weapons. Beginning with orbital mechanics, Mr. del Monte explained that any object in space near the Earth must keep moving to avoid being pulled down by the Earth's gravity. The lower the object's altitude, the greater the gravitational pull, and thus the faster it must move to resist the pull and stay in space. This is a fundamental element of space physics: at each specific distance from the earth, objects must move at a specific speed to stay in orbit at that altitude irrespective of their mass, size or shape. Another unique aspect is that objects in space do not need constant thrust from engines since there is practically no drag in spaceflight. Most satellites are equipped with engines that only need to be used occasionally to change or maintain orbit.

8. Orbits lie on planes that pass through the centre of the Earth. The angle of this plane with respect to the equator is called its inclination. Orbits are also ellipses. A satellite moves faster when close to Earth, at its perigee, and slower when further away, at its apogee. If one were to draw out the path of a satellite directly below it, this would be its

ground track and would show that half of an orbit lies below the equator and half above. A satellite will fly over all points of the Earth between its minimum and maximum latitudes, which are equal to its inclination. The area on Earth visible to a satellite as it passes over depends on its altitude; satellites at higher altitude can view more surface area of the Earth but in lesser detail. Satellites close to the Earth are affected by atmospheric drag which slows them down and eventually pulls them back to Earth. The lower in altitude a satellite is, the more often it must manoeuvre to maintain its orbit and prevent re-entry.

9. There are several orbital options. Low Earth orbit (LEO) is any altitude up to 1,000km and is used most often for Earth observation, science and telecommunications networks. Sun-synchronous orbit is a specific class of LEO that is almost polar, giving satellites in this orbit very consistent illumination of the surface, which offers the best-quality imaging. Medium Earth orbit is designated from 1,500km to 36,000km and is mostly used for navigation constellations like the US Global Positioning System (GPS). Highly inclined orbits, such as Molniya and Tundra, were first conceived of to image latitudes higher than 60° and are used for Earth observation and telecommunications networks in high-latitude regions. Geosynchronous orbit (GEO), at an altitude of around 36,000km, is one of the most important and crowded orbits. Objects orbiting at this altitude remain fixed with respect to a point directly beneath them on the Earth. GEO is most often used for meteorological and telecommunications purposes.

10. Manoeuvring in space, such as changing the orbit of a satellite, requires expending a significant amount of energy. Because equipping a satellite with a large amount of propellant is expensive and difficult, satellites are typically limited in their manoeuvrability. Changing a satellite's inclination requires much more propellant than changing altitude or orbital shape. Recent advancements in propulsion technology allow more velocity change per unit mass of propellant, but cannot be used to manoeuvre quickly, and thus are limited in applicability. This places important constraints on the ability of space objects to avoid debris, while at the same time placing similar constraints on the development of space-based weapon systems.

11. Mr. del Monte then looked at navigating in space. First, routes in space can be very crowded. Satellites are assigned seemingly large three-dimensional orbital positions since there is a significant amount of inaccuracy concerning their exact location, the locations of objects around them, and the ability to precisely control their position and to manoeuvre to avoid collisions. Second, space weather, particularly radiation from the Sun, can sometimes cause satellite malfunction. Third, near Earth objects, such as asteroids, orbit the Sun in highly elliptical orbits, threatening to cross paths with Earth's orbit. The larger of these objects are a potential collision risk with the Earth itself, while smaller micrometeoroids can damage satellites. Certain measures, such as improved space situational awareness (SSA), have been taken to help mitigate these threats. Fourth, orbital debris—defined as any non-functioning, man-made space object—threatens spaceflight safety. It can be launch refuse, paint flecks or even decommissioned satellites—this orbital trash is generally 42% fragmentation debris, 22% non-functioning spacecraft, 19% mission-related debris and 17% rocket bodies. Debris can be very dangerous due to the sheer amount of it, how fast it travels, and its uncontrollability. Currently, there are 19,000 objects larger than 10cm being actively tracked, 500,000 objects between 1cm and 10cm, and probably millions of particles smaller than 1cm that are not actively tracked. While it is impossible to hide in space, it is difficult to monitor and track everything, especially the smallest particles. Still, attempts are being made by a number of states and the satellite industry to monitor objects and prevent collisions or damage.

12. Debris travels at incredibly fast speeds, around 7–8km/s in LEO, and takes a long time to decay from orbit. If it orbits lower than 600km, it will probably return to Earth in a

few years. At 800–850km, where the highest concentrations of debris are located, decay can take decades. At altitudes higher than 1,000km, it could take hundreds of years.

13. Finally, Mr. del Monte discussed whether space is the ultimate “high ground”. Space does offer imaging and communication advantages, but placing weapons there may be neither feasible nor wise. As is well known, space-based assets are essential to most daily economic activities. They also happen to be extremely fragile. Satellites can be harmed in many ways: through electronic or microwave interference, by blinding or “dazzling” them with lasers, through kinetic strikes or collisions, by attacking the ground-based links with the satellite, or through cyber-attack or nuclear explosions. Since satellites are easily tracked and follow very predictable paths, jamming is a major threat and can be accomplished relatively easily. In fact, it is being done already. One could use ground-based lasers to dazzle a satellite’s sensors or to overheat them, but this requires a higher level of technological capacity. High-power microwave weapons can disrupt or damage electrical systems of satellites. Satellites in LEO can be attacked using direct-ascent, mid-range missiles launched from Earth, while higher orbiting objects can be attacked using space-based or longer-range anti-satellite missiles. Attacking an object in GEO using a missile is now possible for at least eight states, but success would require extreme precision. One could also attack a satellite from a co-orbital position, meaning that a typically smaller object would approach and damage another. These technologies have already been developed, though for peaceful purposes, such as for approaching and docking with the International Space Station. Another destructive device called a “space mine” would essentially lie in wait for a satellite to orbit into it, thereby causing harm. As well, a nuclear explosion at a high enough altitude would generate an electromagnetic pulse capable of destroying satellites that were not heavily shielded. The resulting persistent radiation would continue to cause harm over a long period of time. This could potentially take the world back into the 1950s, as any activities reliant on space-based assets—from banking and communications to navigation and weather-monitoring—would be rendered impossible for years afterward.

14. Mr. Brian Weeden, Technical Advisor at Secure World Foundation, began his presentation by reviewing some basic space physics. First, speed and velocity are not independent variables in space. As Mr. del Monte pointed out earlier, objects orbiting at the same altitude in space travel at the same speed regardless of size, mass or shape. Changing the speed of an orbiting object requires changing its altitude. Second, the lack of atmospheric drag in space means that inertia dominates, and this makes it very difficult for objects to manoeuvre in space. Third, at very high speeds, solid objects behave like liquids on collision—the debris field created by two objects colliding in space can be visualized as the crossing of two high-pressure streams of water. Most of the debris will continue in the same orbits as the parent objects, but will diffuse in velocity and orbital height. Over time it will disperse further and cover a wider range of altitudes and inclinations. Mr. Weeden talked about two particular scenarios where orbital mechanics cause surprising results compared to actions on Earth. For example, if an object is thrown away from a satellite, it will drift away and return to the same place it was released from exactly one orbit later. Also, though it would appear to be the case, it is impossible for a satellite to orbit around another satellite. Both objects must orbit around the Earth, while one appears to orbit around the other as seen from the ground.

15. Discussing different kinds of weapons useable in space, Mr. Weeden explained how nuclear weapons behave differently in space than on Earth. Due to the lack of atmosphere, a nuclear explosion will not produce any blast effects in space. Additionally, a nuclear explosion in space will give off less thermal energy, more high-frequency energy such as X-rays and gamma rays, and a greater amount of prompt radiation than one on Earth. In space, the electromagnetic pulse given off by a nuclear explosion will significantly affect space-based operations. It will cause short-term interference with communications and

long-term damage through the creation of artificial radiation belts and the excitation of the Van Allen belts. Mr. Weeden explained the three general types of potential space weapons: Earth-based weapons that travel through space to targets on Earth, Earth-based weapons that target space-based objects, and space-based weapons that target objects on Earth, in the air, or in space.

16. The first category includes medium- to long-range ballistic missiles. A ballistic missile's trajectory is simply an orbit with its perigee located inside the Earth. Most ballistic missiles have apogees higher than LEO satellites, but lack the velocity to remain in space. Though most do not consider ballistic missiles to be space weapons, they can be used as a basis for developing space weapons since, at a fundamental level, the only distinction between a ballistic missile and a space launch vehicle is thrust and payload. Generally, any ballistic missile could be used as a platform for certain types of anti-satellite weapons (ASATs)—it would need only to be paired with an interceptor payload capable of performing the tracking and terminal guidance functions.

17. The second category of space weapons includes direct-ascent ASATs, lasers, and other directed-energy weapons located on the ground which can target objects in space. A direct-ascent ASAT is a ballistic missile with a "kill vehicle" on top. After the missile burns out, the kill vehicle intersects at a precise time with a satellite's orbit. This kill vehicle must be equipped with tracking, guidance and manoeuvring capabilities. The kinetic energy from the collision will destroy the target, though some concepts have considered using nuclear warheads. Earth-based laser weapons would operate by heating their targets, which causes rupture and collapse of weak structures or can blind or damage sensitive optics. Since laser beams travel at the speed of light, dodging such an attack would be virtually impossible. It has been proven that lasers can be used to dazzle or blind satellites, though destruction is not yet operationally feasible. While dodging a laser attack would be difficult, there are other means of protection. For example, if a target were painted white or were reflective in the frequency the laser operates, it would significantly undermine laser capability.

18. The third category includes those weapons located in orbit that could target objects in space or on Earth: co-orbital ASATs, hypervelocity kinetic weapons and space-based lasers. A co-orbital ASAT would comprise an object already in orbit that manoeuvres or waits to intercept the targeted satellite. Although these could also rely solely on kinetic energy to destroy their target, they would probably utilize other destructive means such as releasing a cloud of metal pellets, delivering an electromagnetic pulse, exploding, or attaching to the target and firing thrusters. Hypervelocity kinetic weapons refers to the releasing of heavy metal rods from an orbital platform that, upon striking Earth with incredible kinetic force, would inflict severe damage. While such a weapon system has been discussed, it has never been developed, tested or deployed due to the many challenges—both technical and cost-wise—of implementation. Space-based lasers could be used to destroy ground targets, nuclear warheads on ballistic arcs or other space-based objects. However, space-based lasers would require an immense amount of energy. Such systems have been theorized and partially developed, but never tested, built or deployed. Mr. Weeden concluded his presentation by describing the "grey areas" of space weaponization. For example, he explained how any antenna converted into a jammer could be used to negate or hinder satellite operations. It is impossible to completely prevent such jamming and very difficult to determine intention when it occurs, especially for satellites in GEO. Another grey area is that most missile defense technology has dual-use potential for space weapons since all kinetic hit-to-kill technology is similar.

19. A participant stated that Mr. del Monte's presentation had neglected to acknowledge the role of the 2007 Space Debris Mitigation Guidelines agreed by COPUOS for mitigating the negative effects of orbital debris. Through national adoption, the Guidelines aim to establish a culture of respect for not creating debris in space.

20. On the question of which space weapons should be of urgent priority to the international community, there was a view expressed that jamming and co-orbital capabilities should be prioritized concerns. Jamming capability is far too easy to obtain and inexpensive to go unconsidered in efforts to mitigate threats. In addition, recent advances in technology to closely approach and even dock with non-cooperative satellites raise concerns. While these technologies have beneficial and benign uses, they are dual-use in nature and therefore should be kept in mind as a potential threat.

21. One participant remarked on how little had changed in the realm of space weaponization and threats over several decades and wanted to know what, in fact, had changed over time. Partly, little has changed because the laws of physics remain the same, constraining certain activities and allowing others. On the other hand, space-enabling technology has developed and spread. What were far-fetched ideas several decades ago have now become more possible via technological advancement. Lasers, for instance, were proposed decades ago, but the first airborne laser interception occurred only a few weeks before the conference.

22. Mr. Ray Williamson, Executive Director of Secure World Foundation, then presented on space sustainability, explained threats to it and examined its future. Space sustainability can be described as "using space in such a way that all humanity can continue to use it for socio-economic benefit and peaceful purposes". Maintaining space sustainability will require international cooperation, discussion and agreements since space is a global commons. These measures should be designed to ensure that space is safe, secure and peaceful for the long term.

23. Many things threaten space sustainability. The growth of orbital debris and working satellites since the 1960s has caused the space environment to become incredibly crowded, especially in key orbits. Additionally, frequency interference, deliberate or accidental, threatens space sustainability as well. The International Telecommunication Union labours to prevent accidental interference and seeks to mediate interference disputes. Lastly, space sustainability is threatened by natural space weather events like solar flares, which can interfere with satellite operability, especially in GEO.

24. What are some of the steps necessary for ensuring a sustainable space environment? First and foremost, debris generation must be reduced. The COPUOS Space Debris Mitigation Guidelines adopted by the UN General Assembly in October 2007 are a great tool to do so, but remain voluntary. States could also better implement guidelines and regulations on debris creation and mitigation for domestic space launches and activities. Second, efforts should be made to avoid accidental space collisions—such as the February 2009 collision between a functioning Iridium communications satellite and a defunct Russian Federation military satellite—and to prohibit or limit deliberate, debris-generating satellite destruction. Third, a set of international guidelines should be agreed upon to identify best practices in sustainable space operations and activities. Fourth, civil SSA should be expanded and made freely available. This would make analysis by satellite owners and operators of potential collisions possible, which could help identify ways to prevent them. A good example of such a case took place recently when the United States of America warned Nigeria of a possible collision and Nigeria manoeuvred its satellite to avoid it. The third and fourth steps together would establish the beginnings of a space traffic management regime that could ensure the safe and most efficient use of outer space for all players.

25. Mr. Williamson provided an update on where the international community currently is in this space sustainability effort. In 2008, COPUOS established a Working Group that has now drafted a document on space sustainability best practices, which was released in February 2010. Mr. Peter Martinez was elected as Chair of that Working Group. A meeting will take place in June 2010 to identify the Group's work format and methodology. While

many states are very supportive of the space sustainability effort, they hold diverse views on what it entails. Mr. Williamson also feels there is a general concern among the newcomers to space that they will be left behind by such an effort and will be limited in their space activities as a result.

UN Space Policy—An Integrated Approach

Mr. Ciro Arévalo-Yepes, Ambassador, Chair of the United Nations Committee on the Peaceful Uses of Outer Space

26. In the conference's keynote address, Mr. Ciro Arévalo presented on UN space policy. The UN General Assembly passed a resolution in December 2009 mandating COPUOS to further develop Mr. Arévalo's initiative of constructing an integrated UN space policy.

27. As a result, the policy will be an item on the agenda of the June 2010 meeting of COPUOS. The policy is intended to showcase two aspects of space in relation to the UN system. First, what has the United Nations done for space? The United Nations can be seen as a forum for space governance and it carries out this responsibility in a number of ways: through COPUOS, through multilateral treaties and resolutions, through the Space Debris Mitigation Guidelines and, most recently, through items such as the International Space Weather Initiative. Second, what has space done for the United Nations? This aspect looks at the many ways the United Nations utilizes space in its daily operations. The United Nations is a major user of space with 25 of its agencies and the World Bank system relying on space-based assets to support their activities. Additionally, space enables the United Nations to meet its main goals of peace, security and development.

28. The space arena is rapidly evolving due to globalization, regionalization and privatization. A growing number of actors, both state and non-state, have become increasingly active in space. For example, COPUOS has expanded to include 69 Member States, including the five permanent members of the UN Security Council. Fifty of these members participate in launch activities, nine of which possess national launch capacity. There has also been a willingness from both developed and developing countries to fashion their own space policies, as well as an effort to establish regional space bodies like the Asia-Pacific Space Cooperation Organization and the Asia-Pacific Regional Space Agency Forum. Unfortunately, space resources are limited and crowding brings with it the risk of collisions, congestion and uncertainty about future usability. These challenges have led COPUOS to recognize the need for standards that can guarantee long-term space sustainability and the need to strengthen the international legal regime responsible for space. A coordinated and coherent UN space policy could help guide UN space activities in the face of these challenging circumstances. Such a policy would promote better coordination by addressing the current fragmented nature of UN space activities, would foster orderly and predictable behaviour in the orbital environment, and would create a supportive environment for new space-faring states via regional dialogue.

29. The UN space policy will have six guiding principles. First, activities in outer space should be conducted for peaceful purposes and for the benefit of all mankind. It has become clear that human security on Earth is increasingly linked to a usable and stable space environment. In order to preserve it, any action that might undermine peace and security in space should be prohibited. Thus, the policy would support discussions on PAROS as part of its first guiding principle. Second, space should be used in a fair and responsible manner and in accordance with international law. Third, UN space activities should be coordinated across agencies and departments. Fourth, regional and inter-regional cooperation with

regard to space activities should be encouraged. Fifth, the international community should help all states access the benefits afforded by space. And last, the United Nations should assist states in developing national space policies. There are several ways to bring about a UN space policy, including reinforcing international cooperation at the regional and inter-regional level, strengthening the role of the United Nations by expanding cooperation between UN agencies dealing with space and bolstering the UN Office of Outer Space Affairs, and promoting more dialogue among space-faring states, space-aspiring states, industry and civil society. The UN space policy will be available in all official UN languages at the June 2010 COPUOS meeting.

Session Two

Latest Developments in Space Security

30. The second session began with remarks from Mr. Zhang Ze, Deputy, Director in the Chinese Ministry of Foreign Affairs. He summarized China's view and position on space security and provided an update about the draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT), originally proposed jointly by China and the Russian Federation in 2008. Thanks to significant technological advances, an increasing number of people have been able to benefit from space and as a result it has become indispensable to human activities. Guaranteeing a lasting peace in outer space is critical to global peace, security, prosperity and development. Yet, since the beginning of human activity in space, a gradual arms build-up has threatened this fragile peace. Other challenges threaten it as well, including orbital debris, the potential of satellite collision and the allocation of scarce orbital assignments. There is no doubt that these problems can be solved, but the international community must prioritize its response. It is China's view that establishing and maintaining a "zero-weapons" space environment should take top priority. Negotiating and signing a new legally binding international legal instrument should be the first item on the agenda of space security for several reasons. First, if just one or two weapons are deployed in space, all of the work done in establishing norms and "soft rules" would be laid to waste. Second, the effort to prevent an arms race in space enjoys overwhelming international support. In October 2009, the UN General Assembly passed the PAROS resolution unanimously, with only two states abstaining. Third, while transparency and confidence-building measures (TCBMs) help to prevent conflict by deepening trust and reducing misunderstandings, they rely on good will and volition to remain intact. A new space treaty would be the best kind of TCBM because it would achieve the same ends, but in a legally binding way. Fourth, the existing international law regime concerning space security is insufficient for PAROS. These instruments, such as the Outer Space Treaty of 1967, play an important role in ensuring peace in outer space, but they have obvious limitations. For example, they only prohibit the placement of weapons of mass destruction in space, but not other weapons. Minor amendments will not address these insufficiencies. Fifth, the basis for such negotiations has already been established over the past 10 years through the work of ad hoc committees and informal negotiations in the CD. Most specifically, the joint effort between China and the Russian Federation has laid a solid foundation for such progress. In 2002, China, the Russian Federation, Indonesia, Belarus, Viet Nam, Zimbabwe and the Syrian Arab Republic presented a working paper proposing the PPWT. In 2006, China and the Russian Federation submitted documents with suggestions on transparency, definitions, existing legal instruments and verification. In February 2008, China and the Russian Federation submitted the first draft of the PPWT, which Mr. Zhang felt is a mature foundation for starting relevant negotiations in the CD.

31. Since proposing the draft treaty, China and the Russian Federation have continued to encourage related discussions. In August 2009, China and the Russian Federation presented a document to the CD responding to the major concerns and comments put forth regarding the PPWT draft, including issues of scope of application, definitions, verification, the right of self-defence, dispute settlement and organization. While the document is not perfect, Mr. Zhang argued that it is still the best option available to the CD. He then reviewed the three main goals of the PPWT: no weapons placed in outer space, no use of force against space objects, and no threat or use of force against space objects. China and the Russian Federation will continue to jointly support PAROS discussions in the CD with a view to negotiating an agreement soon. In that, three things should be kept in mind. First, this project should remain open. Though China and the Russian Federation were first to propose it, they still welcome active participation from any party interested in becoming involved. Any proposal advancing PAROS will be valued and considered. Second, this issue should be marked by parity in negotiations. Third, these negotiations should remain inclusive. Only then will the CD be able to accomplish a PAROS treaty that satisfies all partners. China believes that political will and determination among all CD parties are the most critical aspects necessary to progressing from foundations to negotiations.

32. Mr. Laurence Nardon, Head of the USA and Space Policy Programmes at l'Institut français des relations internationales began her presentation with a brief history of the European draft code that became the basis for the International Code of Conduct. Motivated by the evolution toward space weaponization of the early 2000s, a collaborative European effort succeeded in having a draft Code of Conduct adopted by the 27 European Union member states in December 2008. In seeking to bypass the United States of America opposition under the Bush administration to legally binding instruments and in the hopes of complementing the existing body of space law, the Code of Conduct is not meant to be a formal treaty. While not ideal, this allows progress in the interim before a more binding instrument can be successfully negotiated. The Code is based on TCBMs, specifically the nuclear treaties of the 1970s and 1980s between the United States of America and the Soviet Union, which were meant to reassure international partners. Mr. Nardon presented as a model Lars Höstbeck's typology of space TCBMs, which are based on the various stages of space activity. At the first stage of general space-related activities, TCBMs would include declaring a national space policy, sharing information about planned activities and cooperating with others on space-related projects. At the second stage of launch-related activities, TCBMs include notifying others of launches, giving launch demonstrations and inviting observers to launches. At the third stage of orbital activities, effective TCBMs include engaging in responsible space traffic management, establishing and regularly updating a register of space objects, and participating in a common and accessible space surveillance system. For the fourth stage of spacecraft decommissioning and re-entry, TCBMs include notifying others of re-entry and mitigating debris creation. The fifth stage is arguably the most important, and recommends that all actors completely refrain from harmfully interfering with others' space objects.

33. Mr. Nardon explained the specific structure and timeline of the Code. The Code itself is based on and is meant to complement the existing body of space law. Its general measures and principles include refraining from any activity that might cause damage to space objects, debris mitigation, cooperation mechanisms, and organizational aspects. Since being adopted, EU member states have taken the Code to other space-faring states in bilateral consultations with mixed results. The United States of America and Japan received the Code well; others, those states that favour a legally binding treaty, did not. The most interesting debate prompted by the Code pertained to which actors should be involved in space security discussions. Currently, states still make the decisions, but it is important to consider involving private sector actors that are just as intimately concerned with space

matters. Additionally, with the recent ratification of the Lisbon Treaty, many debated what role the European Union should play in the Code of Conduct.

34. Constructive comments were collected, especially on the organizational aspects of the Code, and Mr. Nardon is optimistic that a "rendezvous clause" will be included in the next draft, which will discuss Code parties returning at a later date to negotiate a formal treaty. In 2010, EU member states will rewrite the Code to integrate these comments in such a way that the overall coherence and core principles of the document will not be lost. The revised Code will then be presented in an international forum to be determined. Belgium, which will assume the EU presidency in the second half of 2010, is very active on space issues and hopes to have the revised draft completed and a conference on it convened by the end of 2010. At that point, any state will be able to join the Code and Mr. Nardon believes it will prove a constructive step forward.

35. A representative for Mr. Philip J. Baines, Deputy Director, Missiles, Space Security and Conventional Weapons, in the Non-Proliferation and Disarmament Division of Canada's Department of Foreign Affairs and International Trade, presented remarks on his behalf. States, companies and individuals rely on space for diplomatic, defence, development and economic purposes. It was stated that, "A day without space would be a disaster. The next hundred years without space would be a catastrophe". If the international community does not take immediate collective action to halt the weaponization of space, it will risk losing the myriad benefits from space gained over the past 50 years. China's ASAT test increased the amount of observable orbital debris by 15%. The United States of America has already demonstrated that a modified hit-to-kill ballistic missile defence interceptor can serve as an ASAT. China, France, the Russian Federation, India and Japan all have research and development programmes for hit-to-kill ballistic missile technologies. As long as nuclear-armed ballistic missiles remain a fact of life, so too will the missile systems to defend against them and so long as these systems exist, so too will the ability to attack satellites in orbit. Much thought and funding has been dedicated to simulating scenarios where military means are used to attain space security. In every instance, the outcome has been the same: witnessing the loss of the use of LEO for the next thousand years. The simulations also show that conflict in space can quickly escalate into nuclear war since so many states rely on satellites for strategic and nuclear stability. Another sobering lesson garnered from these simulations is that deterrence may not apply at all in space.

36. The unique makeup of space war creates a military reality that could easily and accidentally lead to wide-scale destruction. While conventional warfare relies on national human-led command authorities, the inevitably rapid nature of potential space war could lead to automated or pre-delegated protection measures, which would increase the risk of conflicts spiralling out of control at any moment. Military theories have favoured "go big or go early" strategies to avoid the crippling effects to national power that the loss of key satellite infrastructure could cause. This unfortunate truth leads to a pre-emptive posture, especially since reaction times would be too short to allow "human-in-the-loop" command and control structures in the event of space hostilities.

37. These widely recognized dangers have been met with different responses by three different camps: minimalists, maximalists and mediators. As the labels indicate, their proposed solutions espouse varying degrees of action, which are inversely proportionate to the space power of the states sponsoring them. The minimalists believe that the current regime governing space is sufficient and that conventional strategies of deterrence apply just as effectively to the space environment as they do elsewhere. They deny the existence of an arms race in space and feel no urgency to pursue diplomatic solutions that may limit their activities in space. Any new agreements on space should be voluntary and not limit the development of current or future capabilities, including military capabilities. While minimalists prefer capabilities that do not permanently damage space objects and encourage

behaviour that minimizes the production of orbital debris, they desire to keep military options available in the event that diplomacy fails to maintain peace and security in space. Conversely, the maximalists feel the immediate need for a legal regime that will ban the placement of weapons in outer space, the use of force against space objects, and limit certain space activities. In the meantime, these states continue the development of their own ASAT capabilities. The mediators, on the other hand, represent a middle ground and propose a layered approach to space security based on diplomatic assurances, residual deterrence through the availability of electronic warfare within the limits of the Charter of the United Nations, and enhanced surveillance through increased SSA and monitoring capacity. Canada is a mediator and has demonstrated this stance by putting forth a proposal in March 2009 that outlines a clear set of rules, a ban on the placement of weapons in outer space, a prohibition of testing or using ASATs, and a prohibition on using or testing satellites themselves as weapons. Immediately, Canada wishes to see the adoption of a voluntary code of conduct and, eventually, the adoption of a legally binding arrangement. Canada's proposal offers a grand bargain between the other two camps. By maintaining an option to use electromagnetic force, space and national security can be guaranteed without causing irreversible damage in space. Methods of verifying compliance will evolve over time, but it is best to address potential new or emergent threats as soon as possible before a crisis arises and clouds judgment. This third way is likely to fulfil the security needs of every state in a way that is equitable and verifiable. The dark lessons learned from the aforementioned simulated war games necessitate a strategy to avoid conflict that is based on reassurance, deterrence and surveillance. The international community, therefore, must engage in preventive diplomacy to achieve such a strategy before a conflict breaks out and the world loses access to the benefits offered by space.

38. The floor was then opened to discussion. One participant pointed out that space security negotiations do not have to be a zero-sum game. The international community is equipped with a wide array of tools, be they norms, soft law, codes of conduct or formal treaties, which can be used in conjunction with one another to achieve the ultimate goal of a peaceful and stable space environment. Another participant expressed the inability to understand why, if the international community so broadly supports peaceful cooperation in space, it is so difficult to achieve a formal treaty preventing space weaponization. It was clarified that the PPWT proposal is not meant to challenge any state's international position or prowess, but rather to promote peace and security in the space domain; and that the sponsors are willing to engage in a broad and inclusive PPWT discussion— including the possible addition of prohibitions on terrestrial ASATs—on the precondition that all participants agree on the necessity of forging a new legally binding instrument to manage space security. It was further pointed out that due to the collective nature of space security, no one state can be completely secure in space without all others being secure as well.

39. It was observed that the discussion focused only on intentional incidents and neglected to address accidents and inoperable or substandard objects. As privatization continues, the potential for defective satellites to be launched into space and then threaten other space-based assets grows. The international community should also take into consideration building norms, regulations and standards for operating in space apart from security arrangements.

40. The modalities for the proposed EU Code of Conduct were discussed, with an opinion being given that the European Union is avoiding a push for a legally binding agreement because a voluntary agreement would likely be quicker and easier to obtain. One participant noted that even if only some states ratify the Code, it would still provide a normative reference against which space behaviour could be judged.

41. Mr. Victor Vasiliev, Deputy Permanent Representative of the Permanent Mission of the Russian Federation to the United Nations Office and other International Organizations

in Geneva, spoke on TCBMs. Russian Federation believes that TCBMs provide a range of benefits: they eliminate possible threats and overcome challenges to peace, security and stability and thus help to ensure them, they facilitate the management of potentially destabilizing situations and thus help to prevent military confrontations, and they make an overall significant contribution to healthy interstate relations. The current challenges in space, as demonstrated by the February 2009 satellite collision and the threat of debris harming the International Space Station, call for multilateral action in the form of anticipating such accidents, providing early warning and enabling preventive action. TCBMs could be a practical part of this effort by reducing the chance of misunderstanding through better communication and increasing stability in space. The application of TCBMs to space security is not a novel idea. Rather, they have been an important part of the body of international institutions, agreements and treaties regarding outer space for decades and continue to be considered an important part of diplomatic arrangements. Some TCBMs are implemented unilaterally and represent individual political commitments, such as the Russian Federation's pledge to not be the first to place weapons in space. This initiative was supported and replicated by members of the Collective Security Treaty Organization in 2005. On the other hand, existing TCBMs are neither comprehensive nor all-encompassing, either in scope or participation. This is primarily due to the fact that, until recently, only a few states could afford space programmes. Now the number of states with space-related programmes has reached 130.

42. It is important that the international community study the results of the review of possible space TCBMs conducted during 1990–1993 by a UN Group of Governmental Experts (see A/48/305 of 15 October 1993), and also the proposals made by states up to now.

43. For the Russian Federation, TCBMs fall into several categories: measures to enhance transparency of space programmes, measures to expand information available on space objects and measures related to rules of conduct for space activities. These measures could be accomplished in several ways including through exchanging information, conducting visits, notifying, consulting and holding thematic workshops. Information could be exchanged on a state's space policies, its research, the orbital parameters of its space objects and on potentially dangerous situations in space. Visits could be conducted by experts to launch sites, flight command control centres and other space facilities. States could also invite observers to launches and equipment demonstrations. Notification can be given of planned launches, scheduled spacecraft manoeuvres that could come close to other states' spacecraft, unguided space objects' descents and predicted impact locations on Earth and spacecraft returns into the atmosphere, especially those carrying nuclear materials. Consultations could be conducted in order to clarify information provided on space programmes and developments, on ambiguous situations and issues of concern, and to discuss the implementation of agreed TCBMs. Thematic workshops could be held on research and various space issues, could be organized on a multi- or bilateral basis and could include scientists, diplomats, military and technical experts.

44. Russian Federation has proposed the creation of a new process for exchange of information on potentially dangerous situations forecast in outer space. By sharing information on predicted events such as potential collisions, through an agreed format, such events may be easier to avoid. It further may be helpful to establish a new UN Group of Governmental Experts to conduct an in-depth study on TCBMs and produce further recommendations regarding these useful tools. Despite their utility, TCBMs should not distract from the ultimate goal of PAROS. While non-binding TCBMs can act as an important step toward this goal, a new treaty preventing the placement of weapons in outer space would be the ultimate TCBM. In the meantime, TCBMs can facilitate such a treaty-building process and should be seen as complementary to that effort, not as detracting from it.

45. The final presentation of the second session was given by Ms. Laura Kennedy, United States of America Ambassador to the Conference on Disarmament. Ms. Kennedy briefed the conference on the ongoing USA space policy review and on the USA stance toward space security challenges. The recent three-year and one-year anniversaries respectively of the Chinese ASAT test and the Iridium–Cosmos collision highlight the need for the United States of America to work closely with other states to further the interests of peace and security in outer space. The Obama administration is currently reviewing USA space policy. One key element of the review examines how to enhance protection of all space-based assets, whether public or private, against "all hazards"—environmental, accidental and intentional. Another key element assesses a range of options for increasing international cooperation in the realm of space security. This review of cooperation includes "blank slate" analysis of options in several areas:

(a) the safe and responsible use of space, including the feasibility of equitable and effectively verifiable arms control measures, codes of conduct and other TCBMs;

(b) potential reforms to the USA export controls governing space-related goods and services;

(c) development of collaborative international arrangements designed to prevent the spread of dual-use space technology to unauthorized actors;

(d) a general expansion of cooperation with allies and partners to advance shared security interests; and

(e) enhanced cooperation with all space-faring states in the peaceful exploration and utilization of space for civil and commercial purposes.

46. Though it is too soon to predict the exact substance of the review, a recent statement made by the USA delegation to the General Assembly of the United Nations reiterated USA commitment to the principles of the 1967 Outer Space Treaty. As the space domain becomes increasingly congested and interdependent, the principles laid out in this regime provide an essential foundation for international cooperation in the realm of space security. Over 21,000 man-made objects orbit Earth, including approximately 1,000 active satellites. This congestion, and the Iridium–Cosmos collision of February 2009, put to rest operator complacency under the "big sky" theory—that is, the attitude that because of the sheer immensity of outer space the probability of collision was extremely low.

47. As a leading space-faring state, the United States of America takes these issues very seriously and will continue to lead in identifying potential hazards and their solutions to protect human and robotic spaceflight. As part of this effort, the United States of America has improved its capacity to track objects in space as well as its ability to predict potential close approaches. As of December 2009, the Joint Space Operations Center at Vandenberg Air Force Base, California, routinely screens every active satellite against other registered space objects for possible close calls and uses this information to notify other countries and commercial operators with the assistance of USA Strategic Command and the Department of State.

48. In addition to being congested, the space domain has grown progressively interdependent and multi-faceted. One reason for this is the expanding range of private companies and public–private partnerships providing competitive services with increasingly capable satellites. This market may even expand to offer logistics support and even space tourism. Another reason is the growing multinational aspect to the commercial uses of space. Many of these commercial companies operate in several countries around the world, providing services to an even wider base of countries. In response, the United States of America is working to improve communications with all satellite operators. Part of this effort involves identifying specific points of contact within other governments so the Joint

Space Operations Center knows whom to contact when a potential close approach is predicted. This will help prevent collisions, but also the potential for misunderstanding or misinterpretation that may arise in the event of an accidental collision.

49. After the Iridium–Cosmos collision, the United States of America engaged in a series of activities that indicate the importance of international cooperation on space security issues. For example, the United States of America was in immediate contact with the Russian Federation, an exchange that was in itself a demonstration of a valuable TCBM. Four months later, experts from both countries met in Vienna to discuss further the incident and its implications for implementing a wider range of TCBMs, and further bilateral discussions are planned to discuss concrete actions, such as expert visits to military satellite flight control centres and discussions on how to exchange information on natural and debris hazards in space. The United States of America also presented to the 52nd session of COPUOS, noting that the collision serves as a reminder of the need to augment international cooperation on ensuring long-term sustainability of operations in space, and is participating in a feasibility study of best practice guidelines that might ensure this long-term sustainability.

50. Furthermore, the United States of America sees a need in this new environment for greater transparency regarding the actions and intentions of all space-faring states, as well as heightened awareness of potential threats to spaceflight safety. One way to achieve this is through bilateral and multilateral TCBMs. Another option is the EU-proposed Code of Conduct, an effort that the United States of America will continue to support. A continued respect of existing space law, enhanced international cooperation, improved SSA and expanded and effective TCBMs are not only in the interest of the United States of America, but also of all space-faring states.

51. Ms. Kennedy expressed her desire to bring a senior member of the USA administration to Geneva to present the Space Policy Review upon its completion. To sum up, Ms. Kennedy characterized the USA administration as “born-again multilateralists”, especially in space.

Session Three

Negotiations of Space Security—Lessons, Models and Directions

52. The final session commenced with a presentation from Mr. Sergey Batsanov, Ambassador, Director of the Geneva Office of the Pugwash Conferences on Science and World Affairs. His gave a comprehensive overview of the types of lessons that can be learned from examining existing arms control agreements. He began with a disclaimer: since negotiations on a space security agreement had yet to begin in earnest, it would be difficult for him to draw relevant lessons from past negotiations on the topic. He gave a brief overview of current space dynamics. The space picture is rapidly evolving with an enormous number of space actors spread across the globe and the number of space-faring states increasing. Space-based military assets are becoming more integrated and irreplaceable. How can these be protected? Armouring space assets would make them too heavy and costly to launch. Using weapons to protect satellites is, therefore, very tempting. The renewed interest in ASATs is one example of this temptation. The technology was considered during the Cold War, but never developed because of a keen understanding of how counterproductive it could be. Some have proposed non-destructive ASATs, which could potentially make banning first-generation ASATs a possibility. Unfortunately, this is unfeasible since such technology would not arrive in all states at the same time and would thus make the ban inequitable.

53. Another question regards what conditions need to be in place for meaningful negotiations on space security to occur. Mr. Batsanov argued that meaningful negotiations cannot happen without first gaining an adequate understanding of the subject matter and the scope of the problem. This does not mean a comprehensive agreement should or will emerge, but a deeper understanding in three areas—the definition of the use and threat of force, TCBMs and space weapons—will help move things forward.

54. Mr. Batsanov describe examples of tactics used in other arms control negotiations and agreements that might prove useful in the PAROS debate. First, regular meetings of experts, like those that occurred during the negotiations of the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT), might be replicated for PAROS. Even when official CTBT negotiations were stalled, a CD working group of technical experts continued to meet and contributed to the overall progress of negotiations. For PAROS, such meetings could be held involving military experts, scientists and industry representatives.

55. Second, industrial involvement, such as occurred during the negotiations of the Biological Weapons Convention and the Chemical Weapons Convention, could prove useful for PAROS. In particular, it would be good to approach industry to help inform the verification issue as the PAROS agreement was taking shape. When industry became involved in the Chemical Weapons Convention debate, the approach to the verification portion of the proposed treaty was dramatically altered.

56. Third, military personnel should be encouraged to talk to each other formally and informally. Such discussions do not have to be broadly multilateral, nor do such discussions need to wait for or necessarily be a part of formal negotiations, but fostering military-to-military discussions in advance will substantially ease the decision-making process for politicians. These discussions should focus on how effective space weapons can really be, what kinds of weapons make the most sense, if any, and whether they will have a strategically destabilizing effect.

57. Fourth, it might be useful to develop basic concepts for a space security treaty among a smaller group of states that can then be passed on to the rest of the international community. During the Cold War, when the United States of America and Soviet Union reached an agreement on arms control, the rest of the world went along with it—which is not the case today, obviously. Nonetheless, it could be useful for the key space-faring states to engage in up-front diplomacy.

58. Mr. Batsanov postulated that there are two ways to approach future space negotiations. One is to look at the existing proposals on the table: the PPWT, USA comments on the PPWT, TCBMs, the EU Code of Conduct and the Canadian proposal. Serious review of these proposals by the international community would create an initial momentum. As drafts of various proposals are revamped and redefined, and perhaps even merged, steps toward consensus can be built. The second approach is to establish parallel working groups. One example of this occurred in the CD over radiological weapons, though it was not a very successful experience since there is still no treaty addressing these types of weapons. All the same, a proposal was put forth to address these weapons and an ad hoc committee was established in the CD with two working groups. In space security, for example, a legal group could be established to look specifically at what has already been accomplished in the UN system so as to avoid duplicating efforts and to perhaps discover existing legal platforms that might relate to PAROS. For the initiation of negotiations, TCBMs could play an important role. Again, historical experience demonstrates this. In the 1970s, the Strategic Arms Limitation Talks laid a foundation for deeper negotiations. These talks helped experts to understand their counterparts' psyches and opened up the lines of communication between the two superpowers.

59. At the end of the process, how should any new space security agreements be codified? One comprehensive agreement could be created, though this would take more time. A chapeau agreement could be created and then additional protocols addressing specific issues or technical aspects could follow, like in the case of the Chemical Weapons Convention. A more general agreement could be formed that would establish some kind of institution or organization that would work on elucidating specific issues and recommending accords for future debate. It is important, as well, to not forget about the Outer Space Treaty, which contains relevant provisions for PAROS and which gave birth to several other agreements after its adoption. Lastly, any new space negotiations will require political commitment—whatever forum is chosen for conducting them in. Mr. Batsanov said that because he essentially "grew up" in the CD, he favours using the CD as a space negotiating body, adding that the advantage of the CD is that the most relevant actors are party to the Conference.

60. Mr. Zhai Yucheng of the Chinese Ministry of Defence spoke next. Though negotiations on space security have been ongoing for decades, the conditions have improved. Space is no longer another battlefield for two superpowers, but a domain for multiple stakeholders. As the number of stakeholders grows, so too does the recognition that weaponization will not ensure space security. Like nuclear war, a space war "cannot be won and should not be fought". This perspective fosters positive negotiations. In order to move forward with these, it is important to examine what has already been achieved and what obstacles still lay ahead. The international community is still divided over space security priorities and solutions. For example, some states believe the greatest threat to space security is the deployment of weapons in outer space. They feel this issue should be solved first with the conclusion of a legally binding treaty. Others feel that irresponsible use of outer space is more urgent and propose instruments that establish norms and define best practice guidelines to address this behavioural issue. Though treaties and agreements have been proposed, states are typically hesitant to adopt them for fear of feasibility issues and restraints on their freedom to operate in space. The international community should not presume that good will suffice. Experiences in multilateral negotiations have shown that only when the unique characteristics of space are considered, equity guaranteed, security concerns addressed and rights balanced against obligations, will an agreement be reached. Since this is a tough task, Mr. Zhai suggested starting with less contentious issues and then developing these step-by-step into a more comprehensive solution when conditions are ripe.

61. In going forward, Mr. Zhai believes the following issues deserve more attention. First, the dual-use nature of space technology will complicate negotiations. For example, any actor capable of launching an object into space is able to attack space-based assets; any satellite with manoeuvrability could be used as a space weapon; any state able to dock its spacecraft with a space station is able to collide with another space object. However, a treaty for space security should not be ratified at the expense of technological innovation and its peaceful application. Therefore, a space treaty will probably need to be general and it is best to remember that all treaties have their limitations, but this does not preclude their utility. A second issue deserving greater attention is the distinction between destructive and non-destructive measures. Many understand that space is too vulnerable a domain in which to conduct destructive activities. Such activities will cause space debris that poses just as much a threat to the initial aggressor as to its targets. Much of the discussion calls for a ban on destructive activities, but does not necessarily prohibit non-destructive measures such as "deceive, disrupt, deny and degrade". Mr. Zhai believes that no distinction should be made between the two since non-destructive activities will certainly provoke destructive responses. Third, because it is often difficult to distinguish between accidental and intentional damage in outer space, he believes any space treaty should provide for making such a determination. Since the potential for a misunderstanding to occur over damage caused in space is both high and dangerous, it is necessary to establish a mechanism for

preventing such misunderstanding. Fourth, because the development of ASAT capability is, to some extent, a response to the increased reliance by militaries on space, any comprehensive solution to the ASAT issue will require restrictions on the military use of outer space. The PPWT could be such a solution. Fifth, a space treaty, especially one limiting space weapons, should not be avoided based on the "right of self-defence" argument. While it is true that by regulating weapons, arms control agreements limit a state's options for self-defence, these restrictions do not substantially hinder a state's ability to defend itself. A future space treaty should either guarantee a state's right to self-defence in the same way the Charter of the United Nations does, provide a retreat clause, or preserve self-defence under strict conditions. The sixth and last priority proposed by Mr. Zhai is the issue of verification and TCBMs. A verification arrangement should be politically acceptable, technologically feasible and economically affordable. For a space treaty, effective verification will need to focus on Earth and space, and monitor systems and behaviour. Such a verification arrangement will be difficult to design and implement for cost and capacity reasons. Despite this, the need for strong verification measures should not be underestimated when constructing a preventive treaty. To a certain extent, TCBMs could supplement verification processes.

62. To conclude, negotiating a space treaty comes down to balance and compromise. It is difficult to say which approach or proposal is best at this moment, but three things are certain: a treaty of non-weaponization is necessary for long-term space stability no such treaty will be perfect, all-encompassing, or easy to achieve; and any treaty process will be difficult not only for all the aforementioned reasons, but also because space itself is such a unique environment.

63. Mr. Jeffrey Lewis, Doctor, Director of the Nuclear Strategy and Nonproliferation Initiative at the New America Foundation, presented next. He began with the disclaimer that it is difficult to discuss verification when a treaty has yet to be established. This topic is also difficult because of the unique characteristics of space, which will fundamentally inform any regime and its verification measures.

64. The international community will never reach a satisfactory definition of a space weapon and it is probably counterproductive to try. The debate about what constitutes a space weapon and how to distinguish between ballistic missile defence systems and closely related ASAT weapons has been going on for decades. Those who argue that space is already weaponized due to the existence of ballistic missiles typically do so in an unconstructive fashion, but their argument is partially valid and worth considering. Ballistic missile technology is inherently the same as ASAT technology, save for the differing rationale. Instead of becoming hindered by the definitional debate, the international community should focus on the nature of space and the particular technologies that concern it the most. For Mr. Lewis, the most urgent priority should be limiting the spread of hit-to-kill technology, which has already been pursued and developed by a number of states including the United States of America, China and India.

65. The question then becomes how to deal with these particular technologies that threaten the peaceful use of space. It may be best to work backwards and shape a space treaty based on what can be verified instead of first formulating the right set of obligations and then figuring out how to verify them. Experiences from the first Strategic Arms Reduction Treaty (START) talks, for example, show that disarmament efforts can be reasonably based on what can be reliably verified. The START I treaty did not count missiles—it counted silos and tubes in submarines, essentially items the other treaty party could see and link to credible disarmament. For a treaty banning ASATs, for example, verification will have to focus on software since the only credible way to determine if a state intends to use its ballistic missile technology for ASATs is in the software.

66. These difficult circumstances will not be solved with more or new technology. This is mainly because the sort of technology used to verify such a treaty is exactly the same technology one would use to harm a satellite. For example, the United States of America has deployed inspection satellites to monitor an ailing satellite, but these inspectors are based fundamentally on technologies originally intended to develop space-based missile interceptors. Unfortunately, the potential benefit from this dual-use technology is too great to expect complete prohibition. Instead, the international community should focus more on PAROS and counteracting the hedging tendencies already developing in states' approaches to the weaponization of space.

67. If it is impossible to ban the relevant technology, an effort should be made to control the use of that technology instead. For example, a system could exist that would limit how lasers are used to track satellites or that establishes rules on how micro-satellites can operate in proximity to other satellites. For hit-to-kill technology, one could imagine a treaty that bans the testing and use of hit-to-kill interceptors that create a massive amount of orbital debris. This is fundamentally verifiable since hit-to-kill testing and use can be seen. Such a treaty or rule would be useful for two reasons. One, because debris creation has such an indiscriminate, negative effect on all space objects, it would make sense to limit it. Two, it points to why such treaties exist in the first place: to mitigate threats. If it is so difficult to define space weapons, it is due in part to the fact that there is an infinite number of ways to harm space objects. Therefore, even if it is unfeasible to completely protect satellites, it is at least possible to mitigate the threat through such a treaty.

68. The floor was given over to questions and discussion. One participant felt that the international community would not be able to negotiate a formal treaty until the problem had become more urgent. For example, it took a considerable amount of nuclear proliferation to generate the momentum necessary for negotiation and adoption of the Treaty on the Non-Proliferation of Nuclear Weapons. This participant also observed how the debate had moved away from preventing an arms race in space and toward managing it. If the focus has shifted way from prevention and toward arms control, this "critical mass" of urgency, marked by significant public pressure and major player buy-in, will need to occur before any agreement can be reached. Thus, the best way forward is finding a way to fill the gaps in the current Outer Space Treaty, which can be achieved through further TCBMs. This participant felt, though, that despite the number of tabled proposals, the PAROS situation had never looked as grim as it does now. According to another participant, while the situation looked grim for PAROS, significant progress has been made in other space security arenas such as debris mitigation and SSA. This progress has been made possible by broad international interest and support, though this has yet to appear for the PAROS debate. This view was echoed by another participant, who noted that there is a growing understanding of how important space is for the whole world and how incredibly vulnerable an environment it is. As a result, states will be very cautious before engaging in activities that could cause damage in space. Moreover, military planners have perhaps overstated the benefit of space weapons. Many of these systems are still far too expensive to develop, test or deploy and this cost will be the basic force constraining space weaponization. Lastly, since technology has changed so much over time, perhaps a traditional treaty structure is not the only way forward. Rather, maybe a mix of other options like a code of conduct or political commitments will suffice.

69. This discussion regarding PAROS was followed by commentary on the two different approaches currently dominating the space security debate. The first, as put forth by China, the Russian Federation and others, prefers to commence negotiations and then deal with definitions, verification and scope. The second prefers to postpone negotiations due to the difficulties with definitions, verification and the ever-emerging challenges arising out of the space environment. This participant's feeling was that the international community needs a common focus to jump-start negotiations. It is also fortunate that the

international community has at its disposal years of discussion on the issue in fora such as the CD and the UNIDIR space conferences and has already, through these avenues, informally agreed to some preventive measures and other disarmament mechanisms. On the feasibility of the PPWT or another legally binding treaty, there are three other precedents to consider. First, the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques models the sort of preventive measures that could be taken in space security. Second, the Chemical Weapons Convention provides an example of a process where a general convention was signed and more specific articles were constructed and agreed to at later dates. Third, the Outer Space Treaty does not include a clear definition of space weapons. What is really necessary, in this participant's opinion, is the political commitment from several states to not use weapons in outer space. If this can be attained, negotiations can begin and technical issues can be clarified later. Political will from leading states will shape these discussions, which will be expanded to include all others later, and the CD is the best forum for such discussions.

70. A point was raised regarding the importance of pursuing effective international verification measures that can distinguish between accidental and intentional satellite interference or damage, especially since most states lack the technical ability to make this distinction. The United States of America is currently the most capable to monitor missile launches and track satellites. If it can be understood that either everyone operates safely and responsibly in space, or that no one will, then cooperative space surveillance will be an obvious outcome.

71. A suggestion was made that perhaps it was counterproductive to debate the wisdom of a definitional or technological approach versus a conduct-based approach to space security—a better way forward might be to mix the two. Many arms control agreements do not have definitions of the weapons they limit or prohibit. So while some space weapons are easily defined and should be, a conduct-based approach should be taken for those grey areas of dual-use technology. A discussion along those lines ensued regarding ballistic missile defence systems: while the feasibility of banning such systems is so low as to be practically non-existent, despite their applicability to ASAT development, a prohibition on testing in an ASAT mode would make states less certain about their ASAT capabilities. There was general agreement that the advent of destructive ASATs or war in space using such debris-creating weapons would be dangerous and counterproductive for all countries, and that some mechanism for preventing this should be created in the near term.

72. The view was expressed that any space security treaty should be universal and equitable, not creating "space weapons powers" and "have nots". One participant noted that the Chemical Weapons Convention was an example of a democratic and even-handed treaty approach. Another view was expressed that any space security agreement must first fundamentally address the use of force in space and the threat of use of force as a legal matter.

Concluding Remarks

Ms. Theresa Hitchens, Director of UNIDIR

73. Ms. Theresa Hitchens, Chair of the conference, delivered the concluding remarks. She sees two key trends as having emerged in the realm of outer space. The first is positive. Space-based assets have grown considerably more valuable to human security and development. As more states have entered and will enter space, they are using it primarily for non-military purposes: to monitor climate change, to support communications and banking, to observe agricultural developments, for tele-medicine and tele-education, and to

generally help people in daily life. This is an irreversible trend that will only result in space becoming more vital to life on Earth. The second trend is less positive, in that space has also grown increasingly militarized as states have learned just how useful satellites are for conducting Earth-based military operations. Unfortunately, these two trends are at odds with each other. As space becomes more vital to the world's militaries, the national security imperative grows to perceive space assets as wartime targets. This reality raises the threat to the peaceful uses of space and thus to human security. One solution to this conundrum is to reframe the issue of space security from a debate between the poles of military utility and the imperative of peaceful uses toward recognition that space security and safety must be preserved in order to prevent unacceptable harm to human life. In looking back at other arms control negotiations and agreements, such as the Anti-Personnel Mine Ban Convention, this is the lens through which the issue was framed and what essentially motivated successful agreements. In the international arena, particularly in the civil and commercial realms, there has been a growing appreciation for the value of space for human security and development. This appreciation has been reflected in a growing interest in international fora such as the International Telecommunication Union and COPUOS. Progress has been made on space security issues such as reduction of interference, debris mitigation and SSA. Perhaps the reason such progress has not been mirrored in the arms control realm is because the space issue is almost always viewed through the lens of national security interests and not human security.

74. A further issue for progress is the level of technical difficulty involved, and how these technical aspects would have a limiting affect on what a treaty and negotiations could achieve. However, there are examples of ways to overcome the technical obstacles from the negotiations on the Chemical Weapons Convention and the CTBT. In these cases, expert groups or smaller sets of leading states met together to lay down foundations that were later introduced into multilateral organizations as the basis for wider negotiations. Since the CD will not overcome non-space-related gridlock any time soon, the international community should work outside the Conference to make progress before the nascent arms race in outer space advances much further.

75. It would also pay to look at previous examples of norm-building that transitioned into legally binding arrangements, such as the Convention on the Law of the Sea. There is no reason TCBMs cannot be pursued first and later be incorporated into a more formal document. Overall, the international community needs to get creative in developing modalities for securing an international agreement. Another experience to learn from is how COPUOS negotiated the Space Debris Guidelines. A bottom-up approach was taken where technical experts met first and built consensus before the issue was broached with diplomats and policymakers. If this is done with a view to preventing unacceptable harm, it might help build momentum in the space weaponization debate. Indeed, the CD would surely benefit from working with other international bodies responsible for space such as the International Telecommunication Union, COPUOS and the other agencies of the United Nations that rely on space-based assets for their daily operations. How can their experiences and expertise be integrated into the process?

76. Another possible angle is to look at harmonizing norms through domestic policy. Russian Federation has pledged not to be a first-mover in the use or threat of use of force in space. Why has this example not been followed by other states? A critical mass of such unilateral declarations could be a norm-building step. The Russian Federation's suggestion of a new UN Group of Governmental Experts on space TCBMs is another potential avenue for progress—even in the absence of formal negotiations. The international community should not let the great stand in the way of the good, but rather should make progress when possible instead of getting stuck on larger, intractable issues. That said, there are fundamental issues that will require more in-depth analysis. While this conference has shown that it is still unclear what constitutes a space weapon, it has not really addressed the

still unclear definition of a space attack or what constitutes aggression in space. Another issue that should be addressed is the linkage between space warfare and the wider nuclear disarmament debate. Satellites are used by nuclear powers to keep an eye on each other's forces, particularly during crisis management and escalation. This is partly why ASAT capabilities were never pursued more fervently during the Cold War, as the two superpowers understood just how important safe satellites were to maintaining the nuclear balance. If one state could not reliably see what was happening with the other's nuclear forces, the potential for initiating an accidental nuclear war increased. Today, this threat is even more prominent as there are now nine nuclear powers using satellites in one way or another to monitor their nuclear rivals. As the international community approaches PAROS or managing the arms race in space, the question of how space warfare may result in nuclear warfare—the ultimate harm to humanity—is something that should be more carefully considered.

77. At the end of the day, Ms. Hitchens stressed, the next step for space security is for the international community to start thinking of, and implementing, creative ways to move past the impasse in formal negotiations.