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# Space Security 2011 Building on the Past, Stepping towards the Future

Conference Report  
4–5 April 2011

UNIDIR/2011/6

**Space Security 2011**  
**Building on the Past, Stepping towards the Future**

Conference Report  
4–5 April 2011

UNIDIR  
United Nations Institute for Disarmament Research  
Geneva, Switzerland



UNITED NATIONS

New York and Geneva, 2011

### **About the cover**

The sodium guidestar provides real-time, high-fidelity tracking and imaging of satellites too faint for conventional optical systems. Scientists at the Air Force Research Laboratory's Starfire Optical Range at Kirtland Air Force Base, New Mexico, use this break-through technology to provide valuable space situational awareness capability.

Image courtesy of the US Air Force.

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UNITED NATIONS PUBLICATIONS

The United Nations Institute for Disarmament Research (UNIDIR)—an autonomous institute within the United Nations—conducts research on disarmament and security. UNIDIR is based in Geneva, Switzerland, the centre for bilateral and multilateral disarmament and non-proliferation negotiations, and home of the Conference on Disarmament. The Institute explores current issues pertaining to the variety of existing and future armaments, as well as global diplomacy and local tensions and conflicts. Working with researchers, diplomats, government officials, NGOs and other institutions since 1980, UNIDIR acts as a bridge between the research community and governments. UNIDIR's activities are funded by contributions from governments and donor foundations. The Institute's web site can be found at:

[www.unidir.org](http://www.unidir.org)



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## FOREWORD

On 12 April 2011 the world celebrated the fiftieth anniversary of Yuri Gagarin's historic flight into outer space. While the launch of Sputnik 1 in 1957 opened the space age and started the Cold War space race, Gagarin's 1961 orbiting of the Earth can truly be said to have demonstrated the power of space to inspire and unify humanity. While only some 500 humans have seen the Earth from space, the human space flight undertaking pioneered by Gagarin has allowed people around the globe to understand the concept of human interdependence and recognize the fragility of our "blue marble" of a planet. Indeed, on 7 April 2011 the United Nations General Assembly declared 12 April as International Human Space Flight Day in honour of Gagarin and in recognition of the important contribution of space science and technology to human development and security.

Much has changed with regard to outer space since 1961. The value of space to global economic development and human security has grown exponentially. Space "touches" every one of us in our daily lives—we use satellites for communications via telephony and the Internet, for banking transfers, for agricultural management, for weather prediction, for disaster relief and telemedicine among many other applications.

At the same time, the space environment has become more vulnerable to degradation and disruption. Space debris pollution and the increase in the number of satellites on orbit have raised the risks of satellite collisions. Crowding in certain highly-desirable orbits has led to friction among states wishing to utilize those orbits. And, of even greater concern is the fact that as more states seek to gain military and political advantage through the use of space assets, the risk of conflict in space has grown. Indeed, the International Telecommunication Union has noted in recent years an alarming up-tick in instances of deliberate interference with satellites.

The twin issues of securing space for peaceful purposes and the prevention of an arms race in outer space (PAROS) have been on the international agenda for decades. Since 2002 UNIDIR's annual space conference has sought to build support for multilateral approaches to prevent or mitigate threats to space sustainability and security. However, only in the past few



years have efforts to craft multilateral discussions begun to ripen into action. For example, in 2010 the UN General Assembly passed a resolution to establish a Group of Governmental Experts on transparency and confidence-building measures for space, the Committee on the Peaceful Uses of Outer Space launched work on developing best practices to ensure the long-term sustainability of the space environment, the European Union began discussions with non-EU states on its proposed international Code of Conduct for space, and Russia and China intensified efforts to promote within the Conference on Disarmament the negotiation of a treaty to prevent the weaponization of space. Therefore, the 2011 conference, *Space Security 2011: Building on the Past, Stepping towards the Future*, was focused on these and other nascent building blocks of a coherent regime for space security. The conference explored legal, technical and political opportunities and challenges to various approaches and activities, such as verification of a future accord. While there is a long road ahead in the quest to secure space for future generations, it is apparent from the high level of participation and engagement at the conference (including the presence of many experts from capitals) that the first steps down that road are finally being taken. There is thus cause for optimism.

On a personal note, I want to take the opportunity to extend my sincere gratitude to Sergei Ordzhonikidze for his strong support of the annual space conference, and of UNIDIR as an institution, during his tenure as Director-General of the United Nations Office at Geneva and Secretary-General of the Conference on Disarmament. His enthusiastic presence will be missed.

Theresa Hitchens  
Director  
UNIDIR

## ACKNOWLEDGEMENTS

UNIDIR would like to thank all of the speakers at the conference for their expert and intellectual contributions: Tal Dekel, Beatrice Fihn, David Finkleman, Emmet Fletcher, Steven Freeland, Annalisa Giannella, Yvon Henri, Lars Höstbeck, Sergey Koshelev, Michael Krepon, Ram Levi, Larry MacFaul, Ambassador Paul Meyer, Laurence Nardon, Dumitru-Dorin Prunariu, Frank Rose, Victoria Samson, John Sheldon and Zhang Ze.

We would also like to thank Sergei Ordzhonikidze for his support of this conference series during his term as Director-General of the United Nations Office at Geneva and Secretary-General of the Conference on Disarmament.

UNIDIR expresses gratitude to the Governments of Canada, the People's Republic of China, the Russian Federation and the United States of America, as well as to Secure World Foundation and The Simons Foundation, for financial, political and material support of this conference.

In Geneva, UNIDIR would like to thank Ambassador Marius Grinius and Geoff Gartshore of the Permanent Mission of Canada, Ambassador Wang Qun, Li Yang and Li Chijiang of the Permanent Mission of the People's Republic of China, Ambassador Valery Loshchinin and Victor Vasiliev of the Permanent Mission of the Russian Federation, and Ambassador Laura Kennedy and Demitra Pappas of the Permanent Mission of the United States of America.

We are also indebted to Cynda Collins Arsenault, Ray Williamson, Victoria Samson, Ben Baseley-Walker and Tiffany Chow of Secure World Foundation, as well as to Jennifer Allen Simons and Paul Meyer of The Simons Foundation for their unwavering support for this series of conferences.

Anita Blétry, Jason Powers, Tae Takahashi and Kerstin Vignard followed this report through the production phase.



## ABOUT THE SPEAKERS

### **Ben Baseley-Walker**

Advisor, Security Policy and International Law, Secure World Foundation

Ben Baseley-Walker is Advisor on Security Policy and International Law for the Secure World Foundation. With significant experience in international relations, international law and strategic communications, Mr. Baseley-Walker brings an innovative strategic approach to his work facilitating and supporting international dialogue on space and international security. His diplomatic skills, coupled with his deep understanding of international space policy, have guided Secure World Foundation's efforts in the fields of space governance and sustainability. Engaging with national and international policymakers, Mr. Baseley-Walker has been instrumental in building and strengthening relationships among the often disparate international law, foreign policy and space security communities. Currently, Mr. Baseley-Walker is engaging the international community, especially emerging space states, in looking at new methods for multilateral negotiations of space-related international security issues. He has contributed to the work of various United Nations fora including the Committee on the Peaceful Uses of Outer Space, the Conference on Disarmament and the General Assembly. In that capacity, he delivered in May 2009 the first ever presentation from a non-governmental organization to an informal plenary session of the CD, speaking on the topic of space security. Mr. Baseley-Walker is a former Chair (President) and current member of the Advisory Board of the Space Generation Advisory Council, a non-governmental organization that represents students and young space professionals to the United Nations, states and space agencies. He also has extensive experience in print and broadcast media. Before joining Secure World Foundation, Mr. Baseley-Walker worked in international relations and international law in East Africa with the Kenya National Commission on Human Rights, the Ethiopia International Law Project and the United Nations High Commissioner for Refugees in Nairobi, Kenya. Mr. Baseley-Walker studied international and European law at the Universiteit van Amsterdam Law School in the Netherlands, and politics at the University of Edinburgh in Scotland. He is also a graduate of the International

Space University Space Studies Programme. He is a member of the American Society of International Law.

**Tal Dekel**

Research Fellow, Yuval Ne'eman Workshop for Science, Technology and Security, Tel Aviv University

Tal Dekel is a PhD student and Research Fellow at the Yuval Ne'eman Workshop for Science, Technology and Security, Tel Aviv University. His research deals with national security issues, space and cyberspace security. Mr. Dekel is a homeland security technology expert and CEO of a leading consulting firm. He has extensive experience in project management and research and development and holds an MSc in electro-optical engineering from Tel Aviv University. His research was in the field of "Light Matter Interaction—Sensitive Spectroscopy Methods". Mr. Dekel graduated with his BSc with honours in physics and mathematics as part of the exclusive Israel Defense Forces "TALPIYOT" programme. He served 11 years in the Israel Defense Forces and is a retired major. During his army career, he served in various research and development positions.

**Beatrice Fihn**

Project Associate, Reaching Critical Will

Beatrice Fihn is the project associate of Reaching Critical Will and monitors the UN disarmament machinery, in particular the Conference on Disarmament, the Treaty on the Non-Proliferation of Nuclear Weapons and the First Committee of the General Assembly. She has worked extensively on civil society engagement in the UN disarmament machinery and contributed with writing, research and presentations in various fora. Prior to this position, Ms. Fihn worked as a research officer at the Geneva Centre for Security Policy, where she carried out research on geopolitics and global security in areas such as outer space and emerging strategic technologies. Ms. Fihn has a Bachelor's degree in international relations from Stockholm University and an LLM in public international law from the University of London.

**David Finkleman**

Senior Scientist, Center for Space Standards and Innovation, Analytical Graphics, Inc.

David Finkleman is an internationally recognized expert in space systems technology and operation, airspace control, data fusion and operations analysis. He is currently Senior Scientist for the Center for Space Standards and Innovation at Analytical Graphics, Inc. and Chief Engineer for SkySentry, LLC. Prior to that, he served nearly 20 years as Chief Technical Officer and Director of Analysis for the North American Aerospace Defense Command, the United States Space Command and the United States Northern Command. He has managed major development programmes. He was elected a Fellow of the American Institute of Aeronautics and Astronautics early in his career for accomplishments in aerodynamics, gas dynamics and high-energy laser technology. He is also a Fellow of the American Astronautical Society and the American Association for the Advancement of Science. He is a five-time Paul Harris Fellow of Rotary International. Dr. Finkleman chairs the Space Operations and Ground Support Working Group of the International Organization for Standardization and serves on several government independent-review teams. He received his Bachelor's degree from Virginia Polytechnic Institute and State University and his Master's and Doctorate from the Massachusetts Institute of Technology. He has published widely.

**Emmet Fletcher**

Space Surveillance and Tracking Manager, European Space Agency

Emmet Fletcher has been involved in flight dynamics, space situational awareness and orbital surveillance for the majority of his professional career. He holds a Bachelor's degree in aerospace engineering, a Master's degree in astronautics and space engineering and an MBA specializing in innovation. Mr. Fletcher previously worked with diverse government, military and private sector organizations to improve data fusion and interpretation systems—specifically when dealing with real-time tracking data from radar and optical sources. He currently leads the Space Surveillance and Tracking efforts of space situational awareness programme at the European Space Agency.

**Steven Freeland**

Professor in International Law, University of Western Sydney

Steven Freeland is Professor in International Law at the University of Western Sydney, Australia, where he teaches both postgraduate and undergraduate students in commercial aspects of space law, international criminal law, public international law and human rights law. He is also Associate Head of School (Research) and coordinator of the school's International Law Mooting Program. He is a Faculty Member of the London Institute of Space Policy and Law and a Visiting Professor in International Law at the University of Copenhagen, Denmark, and has taught courses and presented guest lectures at universities in Australia, Bulgaria, Denmark, the Netherlands, Singapore and the United States. He is also a Visiting Professional within the Appeals Chamber at the International Criminal Court and has been a Special Advisor to the Danish Foreign Ministry in matters related to the International Criminal Court. Among other appointments, he is a Director and member of the Directorate of Studies of the International Institute of Space Law, a member of the Space Law Committee of the International Law Association, a member of the Australian and New Zealand Society of International Law, a member of the SUR/United Nations Human Rights University Network and a Fellow of the Tim Fischer Centre for Global Trade and Finance. He sits on the editorial board of the *Australian Journal of Human Rights*, the *Australian International Law Journal* and the China-based *Space Law Review*, as well as of a series of books entitled *Studies in Space Law*. He is also actively involved in the publication of a series of casebooks annotating the jurisprudence of the International Criminal Court, the International Criminal Tribunals for the former Yugoslavia and for Rwanda, the Special Court for Sierra Leone and the Special Panels for Serious Crimes in East Timor. He has published extensively on various aspects of international law, and is a frequent speaker at national and international conferences, having been invited to present conference papers, public lectures and keynote speeches in Australia, Austria, Belgium, Bulgaria, Canada, China, the Czech Republic, Denmark, France, Germany, India, Italy, Japan, the Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom and the United States.

**Annalisa Giannella**

Director for Non-Proliferation and Disarmament, European Union

Annalisa Giannella started her career as a European official in 1972, gaining a wide range of experience in all areas of European policy. She worked on European Community matters until March 1994 in the fields of environmental protection and internal markets (financial services and company law, among others). She participated in international negotiations in various configurations and was in charge of the Secretariat for the European Economic Community–Switzerland agreement on insurance, the Lugano Convention with the European Free Trade Association states on recognition and execution of judicial decisions, and the international Bankruptcy Convention. In 1994, she began her professional activity in the areas of Common Foreign and Security Policy (CFSP) and European Security and Defence Policy (ESDP), first as Head of Division for Security Issues and, from September 1999, as Director for Security and Defence Policy. In this capacity she contributed to the development of the ESDP. From February 2002 to August 2003, Ms. Giannella was appointed Deputy Secretary-General to the European Convention.

On 10 October 2003, the High Representative for CFSP, Javier Solana, appointed her as his Personal Representative for non-proliferation of weapons of mass destruction to coordinate, help implement and further develop the EU WMD Strategy (adopted by the Council in December 2003), and to give sharper focus to these issues in dialogue with third states. Her office was also responsible for the implementation of the EU Small Arms and Light Weapons Strategy, adopted in 2005, and for EU policy in the area of conventional arms exports controls. From 2004, she assisted the High Representative for CFSP and three EU member states (Germany, France and the United Kingdom) in negotiations with Iran on its nuclear programme. Since the establishment of the European External Action Service, she has been Head of the Non-Proliferation and Disarmament Department, covering all weapons of mass destruction, missiles and conventional arms issues, as well as the EU initiative for an international Code of Conduct for outer space activities. In 2003, she was awarded the title of *Commendatore* by the President of the Italian Republic. In 2006, she received the French *Légion d'Honneur*. Ms. Giannella, an Italian national, was born in Bari, Italy, and holds a degree in political science.



**Marius Grinius**

Ambassador and Permanent Representative of Canada to the United Nations and to the Conference on Disarmament

After 12 years of military service in the Canadian Army, Ambassador Marius Grinius joined the Canadian Foreign Service in 1979. He had two postings to Thailand, one to the Canadian Delegation to the North Atlantic Council (NATO), and two postings to the Socialist Republic of Vietnam, with the second as Ambassador. His tours of duty at the Department of Foreign Affairs and International Trade Canada in Ottawa included Desk Officer for Nuclear Arms Control and Director of the Asia Pacific South and Southeast Arms Divisions. More recently, Mr. Grinius had a series of assignments in Ottawa, including in the Privy Council Office as Principal Analyst in the Social Development Policy Secretariat and as Director of Operations in the Security and Intelligence Secretariat, as well as Director-General of Operations in the Department of Western Economic Diversification. After concluding his tour as Ambassador to the Republic of Korea and to the Democratic People's Republic of Korea, he was posted to Geneva as Ambassador and Permanent Representative to the Office of the United Nations and to the Conference on Disarmament. Mr. Grinius has a BA in economics from the Royal Military College of Canada.

**Yvon Henri**

Chief, Space Services Department, Radiocommunication Bureau, International Telecommunications Union

Yvon Henri is Chief of the Space Services Department at the Radiocommunication Bureau of the International Telecommunication Union (ITU) in Geneva, Switzerland. Before joining ITU in 1995, he held various management positions at France Telecom (Paris) and INTELSAT (Washington DC) and has been involved in the satellite business for more than 25 years. ITU is the leading UN agency for information and communication technology issues, and the global focal point for governments and the private sector in developing networks and services. For 145 years, ITU has coordinated the shared global use of the radio spectrum, promoted international cooperation in assigning satellite orbits, worked to improve telecommunication infrastructure in the developing world, established the worldwide standards that foster seamless interconnection of a vast range of

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communications systems and addressed the global challenges of our times, such as mitigating climate change and strengthening cybersecurity.

**Lars Hstbeck**

Deputy-Head, Division of Defence and Security Systems and Technology, Swedish Defence Research Agency (FOI)

Lars Hstbeck joined the Swedish Defence Research Agency (FOI) Division of Defence Analysis in June 1995, and worked for four and a half years on various operations research projects related to naval planning and exercise evaluation. From 1 January 2000 to 31 January 2003, Mr. Hstbeck was head of the Department for Naval Sensor Systems. The research conducted in the department focused on underwater sensors and signatures. From 1 February until 31 December 2006, Mr. Hstbeck worked part time on various space projects, while at the same time holding the position of Deputy Head of Division of Systems Technology at FOI. Between January 2007 and February 2008, Mr. Hstbeck worked with research strategy and coordination at FOI, focused on research for the Swedish Armed Forces. Between March 2008 and February 2009, Mr. Hstbeck was on leave from FOI and served as special adviser to the Minister for Trade at the Swedish Ministry for Foreign Affairs, focusing on issues regarding the control of weapons exports and non-proliferation. Since March 2009, Mr. Hstbeck is back with FOI at the position of Deputy-Head of Division for Defence and Security, Systems and Technology. In parallel to that, Mr. Hstbeck works with international cooperation at FOI. He has served as an expert on a number of space projects for the armed forces including the special reports to the government in 2005 and 2006. He has also been adviser to the Ministry for Foreign Affairs regarding space security and space aspects of arms control and non-proliferation. Mr. Hstbeck has a Master's degree in physics from the Royal Institute of Technology in Stockholm.

**Sergey Koshelev**

Deputy-Director, Department of Security and Disarmament Affairs, Ministry of Foreign Affairs, Russian Federation

Sergey Koshelev graduated in 1983 from the Institute of Afro-Asian Studies, Moscow State University, after which he served in New

Delhi from 1988 to 1992. From 1995 to 1998, he was in charge of export control issues at the Russian Ministry of Foreign Affairs' Department for Security Affairs and Disarmament. From 1998 to 2003 Mr. Koshelev was appointed counsellor to the Permanent Mission of the Russian Federation to the Conference on Disarmament in Geneva (with a specific focus on a fissile material cut-off treaty, the prevention of an arms race in outer space and small arms and light weapons). Since 2003 he has been the Chief of the Multilateral Disarmament Division, Deputy Director of the Department for Security Affairs and Disarmament of the Russian Ministry of Foreign Affairs. Mr. Koshelev is a member of the UN Secretary-General's Advisory Board on Disarmament Matters since 2009.

**Michael Krepon**

President Emeritus, Henry L. Stimson Center

Michael Krepon is co-founder of the Henry L. Stimson Center and director of the South Asia and Space Security programmes. He has championed confidence-building and nuclear risk-reduction measures between India and Pakistan, several of which have subsequently been implemented. He has mentored more than 70 visiting fellows from the region, and has worked on the general outlines of a Kashmir settlement. Mr. Krepon is the author or editor of 13 books and more than 350 articles. Prior to co-founding the Stimson Center, he worked at the Carnegie Endowment for International Peace, the US Arms Control and Disarmament Agency during the Carter administration and in the US House of Representatives, assisting Congressman Norm Dicks. Mr. Krepon's current research focus is on nuclear stability and crisis management in South Asia. His work on space security centres on the promotion of a code of conduct for responsible spacefaring states, which has subsequently been endorsed by the European Union and the Obama administration. Mr. Krepon received an MA from the School of Advanced International Studies at the Johns Hopkins University and a BA from Franklin and Marshall College. He also studied Arabic at the American University in Cairo.

**Ram Levi**

Research Fellow, Yuval Ne'eman Workshop for Science, Technology and Security, Tel Aviv University

Ram Levi is a research fellow at the Yuval Ne'eman Workshop for Science, Technology and Security at the Tel Aviv University, specializing in the fields of space policy and security, cyberpolicy and security, and national security. In 2010, Mr. Levi was a member of the President's Committee on the Israeli National Space Programme. He is a graduate of the International Space University and holds a degree in computer science from the Herzliya Interdisciplinary Centre. Currently he is writing his thesis on space and cyberspace at Tel Aviv University. Mr. Levi has been lecturing on matters of space for years now. A retired major of the Israel Defense Forces Mamram Technological Units, during his 12 years of service Mr. Levi was an awarded research and development department commander and accumulated extensive experience in research and development and management.

**Larry MacFaul**

Senior Researcher, Verification Research, Training and Information Centre

Larry MacFaul is a Senior Researcher at the Verification Research, Training and Information Centre (VERTIC), an organization that supports the development and implementation of international agreements and related initiatives in the areas of arms control, disarmament and the environment. He works with VERTIC's arms control and disarmament programme and manages the organization's environment programme. Mr. MacFaul carries out research and analysis in environmental and arms control agreements and related areas. He also engages in capacity-building initiatives and project development. He has written, published and spoken widely at national and international fora in collaboration with other organizations. He is editor of VERTIC's publication *Trust & Verify* and is on the editorial board of the international journal *Climate Law*. Mr. MacFaul holds a Master's degree in environmental assessment and evaluation from the London School of Economics and a Bachelor's with Honours in classics from Oxford University.

**Paul Meyer**

Senior Fellow, The Simons Foundation; Fellow in International Security, Simon Fraser University

Ambassador (ret.) Paul Meyer is Senior Fellow, The Simons Foundation, and Fellow in International Security at the Centre for Dialogue, Simon Fraser University, Vancouver, Canada. He retired in September 2010 from the Department of Foreign Affairs and International Trade, Canada, after a 35-year career as a Foreign Service Officer working primarily on international security issues. He served as Director General of the Security and Intelligence Bureau (2007–2010) and as Canada’s Ambassador and Permanent Representative to the United Nations and Conference on Disarmament in Geneva (2003–2007). His research interests include outer space security, nuclear non-proliferation and disarmament, cybersecurity and the application of diplomacy to conflict prevention.

**Laurence Nardon**

Senior Research Fellow, Space Policy Programme, United States Programme, Institut français des relations internationales

Laurence Nardon is a Senior Research Fellow at IFRI, the French Institute for International Relations in Paris, where she is in charge of the Space Policy Programme and the United States Programme. Prior to joining IFRI, Dr. Nardon was a research analyst at Aérospatiale (now EADS Space Transportation), then at the École des hautes études en sciences sociales where she participated in an “Observatory on US Military Strategy”. She was a Senior Visiting Fellow at the Center for Strategic and International Studies in Washington from 2001 to 2003. Dr. Nardon holds a PhD in political science from Université Paris-1 Panthéon-Sorbonne. She studied at the University of Kent at Canterbury after graduating from the Institut d’études politiques de Paris. In the fall of 2000, she was a postdoctoral Fulbright Scholar at the Space Policy Institute at George Washington University. Her dissertation on “Space Observation as an Instrument of Power in International Relations, the US and their Observation Satellites, 1955–1985” received the highest marks in 1999. It was published in 2001 by Presses du Septentrion. An English version was published as an article in *Astropolitics*. Most of her publications, either on space policy or US policy issues, are accessible online on the IFRI website.

**Dumitru-Dorin Prunariu**

Chair, United Nations Committee on the Peaceful Uses of Outer Space

Dumitru-Dorin Prunariu is a retired Romanian astronaut who flew aboard Soyuz 40. He was selected for spaceflight training in 1978 as a part of the Intercosmos Programme. Obtaining the maximum marks during three years of preparation, he was selected for a joint space flight with Russian cosmonaut Leonid Popov. In May 1981 they completed an eight-day space mission on board Soyuz 40 and the Salyut 6 space laboratory where they completed scientific experiments in astrophysics, space radiation, space technology, space medicine and biology. Dr. Prunariu became the 103rd human being to fly into outer space. In 1981, after completing the flight, he received the awards of Hero of the Socialist Republic of Romania and Hero of the Soviet Union (22 May 1981) and the medal "Golden Star". He was also awarded the Order of Lenin. Dr. Prunariu is a member of the International Academy of Astronautics (1992—corresponding member, 2008—full member) and a member of the Romanian National COSPAR Committee (1994). In 1984 he was awarded the "Hermann Oberth Gold Medal" by the German Rocket Society "Hermann Oberth—Wernher von Braun". In 1985 Dr. Prunariu joined the Association of Space Explorers, which currently comprises over 325 individuals from 35 countries. From 1993 to 2004 he was the permanent representative of the Association of Space Explorers at the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) sessions. Since 1996 Dr. Prunariu has been a member of the Executive Committee of Association of Space Explorers for two terms of three years. Since 1992 he has represented the Government of Romania to the COPUOS sessions. Since 1995 Dr. Prunariu has been the Vice-President of the International Institute for Risk, Security and Communication Management in Bucharest. From 1998 to 2004 he was the President of the Romanian Space Agency, and from 2000 an Associate Professor on geopolitics within the Faculty of International Business and Economics, Academy of Economic Studies, Bucharest. In 2004 he was elected as the Chairman of the Scientific and Technical Subcommittee of COPUOS for a two year term. On 1 December 2000 he was appointed a Grand Officer of the Order of the Star of Romania. For one and a half years starting in May 2004 he was the Ambassador Extraordinary and Plenipotentiary of Romania to the Russian Federation. In February 2007 he completely retired from the Ministry of Defence with the rank of Major-General, continuing

to work in the same positions as a civilian servant. Until September 2008 he performed the duties of Director of the Romanian Office for Science and Technology to the European Union in Brussels. Currently, Dr. Prunariu is working for the Romanian Space Agency as an expert within the Airspace Consulting Association. He was elected Chairman of COPUOS for the period of June 2010 to June 2012. In addition to that, at the XXIII Congress of the Association of Space Explorers that took place in Kuala Lumpur, Malaysia, 5–10 October 2010, Dr. Prunariu was elected President of the newly organized chapter of the association, ASE Europe. Dr. Prunariu is a co-author of several books regarding space technology and space flight and has presented and published numerous scientific papers. His doctoral thesis produced new developments in the field of space flight dynamics.

**Frank Rose**

Deputy Assistant Secretary for Defense Policy and Verification Operations, Bureau of Verification, Compliance and Implementation, US Department of State

Frank Rose currently serves as the Deputy Assistant Secretary of State for Defense Policy and Verification Operations in the Bureau of Verification, Compliance and Implementation at the US Department of State. In this position, he is responsible for advising the Assistant Secretary and, as required, the Undersecretary for Arms Control and International Security, on key issues related to arms control and defence policy. These issues include missile defence, military space policy, defence acquisitions and conventional arms control. His responsibilities also include liaison with the US intelligence community on issues related to the verification of arms control treaties and agreements. Prior to joining the State Department in June 2009 Mr. Rose held various national security staff positions in the US House of Representatives, including service as a Professional Staff Member on both the House Armed Services Committee and the House Permanent Select Committee on Intelligence, where he focused on missile defence, defence policy and intelligence issues. Mr. Rose has also held numerous positions within the Office of the Secretary of Defense, including as Special Assistant to the Assistant Secretary of Defense for Strategy and Threat Reduction, and as Policy Advisor in the Office of the Assistant Secretary of Defense for International Security Policy. Previous to that, he worked as a national security

analyst with Science Applications International Corporation, and on the staff of US Senator John F. Kerry. Mr. Rose received his Bachelor's degree in history from American University in 1994 and a Master's degree in war studies from Kings' College, University of London, in 1999. He is a recipient of the Department of Defense Exceptional Public Service Award (2001) and the Office of the Secretary of Defense Medal for Exceptional Civilian Service (2005).

**Victoria Samson**

Washington Office Director, Secure World Foundation

Victoria Samson is Washington Office Director for Secure World Foundation and has more than 12 years of experience in military space issues. Her diverse and rich professional experience ranges from consulting on war-gaming scenarios for the US Missile Defense Agency's Directorate of Intelligence, to providing high-level policy and budgetary analysis, to her current role in which she engages with US policymakers and governmental officials on matters related to space security and governance. Among her significant previous positions, Ms. Samson served as a senior analyst for the Center for Defense Information (CDI), where she leveraged her expertise in missile defence, nuclear reductions and space security issues to conduct in-depth analysis and medial commentary and, in doing so, raised CDI's profile and credibility on timely and contested issues. Prior to her time at CDI, she was the Senior Policy Associate at the Coalition to Reduce Nuclear Dangers, a consortium of arms control groups in the Washington area where she worked to share information quickly and efficiently between congressional staffers, members of the media, embassy officials, citizens and think-tanks dealing with national missile defence and nuclear weapons reductions. Known throughout the space and security arena as a thought leader on policy and budgetary issues, Ms. Samson is often interviewed by multinational media outlets, including the *New York Times*, *Space News*, and National Public Radio. She is also a prolific author of numerous editorials, analytical pieces, journal articles and electronic updates on missile defence and space security matters.



**John Sheldon**

Professor, Space and Cyberspace Strategy, US Air Force School of Advanced Air and Space Studies; Deputy Director, US Air Force Space and Cyber Strategy Center

John Sheldon is professor for space and cyberspace strategy at the School of Advanced Air and Space Studies (SAASS) of the US Air Force and Deputy Director of the US Air Force Space and Cyber Strategy Center. At SAASS he directs and teaches the Information, Intelligence and Cyberpower course and the Space and National Security course. Prior to his appointment in August 2006 at SAASS, Dr. Sheldon was director of the Space Security programme at the UK-based Centre for Defence and International Security Studies, and was a founding co-editor of the space policy journal *Astropolitics*. Prior to his academic career, Dr. Sheldon served in the British Diplomatic Corps. Dr. Sheldon has lectured on cyberspace and military space issues at the Higher Command and Staff Course, UK Defence Academy, Shrivenham, the Royal United Services Institute, London, and the US Air Force Academy. He has published numerous chapters and articles in various edited works, journals and trade publications. Dr. Sheldon holds a Bachelor's (hons.) in politics and international relations and a Master's degree in security studies from the University of Hull, and a PhD in political science and strategic studies from the University of Reading.

**Wang Qun**

Ambassador, Disarmament Affairs and Deputy Permanent Representative to the United Nations Office at Geneva and Other International Organizations, People's Republic of China

From 1986 to 1990 Ambassador Wang Qun was staff member and attaché, Department of Translation and Interpretation, at the Ministry of Foreign Affairs of the People's Republic of China. From 1990 to 1993 he was appointed Third Secretary at the Office of the Chinese Senior Representative, Sino-British Joint Liaison Group in Hong Kong. From 1993 to 1995 he served as Third Secretary at the Department of International Organizations and Conferences of the Ministry of Foreign Affairs and from 1995 to 1998 he was Third Secretary and Second Secretary at the Permanent Mission of the People's Republic of China to the United Nations in New York. From 1998 to 2001 Ambassador Wang was appointed Second Secretary, Deputy Director

and Director of the Department of Disarmament and Arms Control at the Ministry of Foreign Affairs and from 2001 to 2004 he served as Counsellor at the Permanent Mission of the People's Republic of China to the United Nations and Other International Organizations in Vienna. Between 2004 and 2007 he was Deputy Director-General of the Department of Disarmament and Arms Control at the Ministry of Foreign Affairs and in 2007 he was appointed as Ambassador Extraordinary and Plenipotentiary for Disarmament Affairs and Deputy Permanent Representative of the People's Republic of China to the United Nations Office at Geneva and Other International Organizations in Switzerland.

**Zhang Ze**

Deputy-Director, Ministry of Foreign Affairs, People's Republic of China

Zhang Ze is Deputy-Director in the Ministry of Foreign Affairs, Arms Control and Disarmament Department, of the People's Republic of China. He has extensive experience in multilateral affairs, specifically in the disarmament field. Mr. Zhang was assigned to the Chinese Permanent Mission in Geneva during 2003 to 2008 and has worked extensively with a number of important international bodies, such as the World Health Organization, the Human Rights Council and the Conference on Disarmament.



## CONFERENCE REPORT

“Space Security 2011: Building on the Past, Stepping towards the Future” was the tenth annual conference in the series organized by the United Nations Institute for Disarmament Research on the issue of space security, the peaceful uses of outer space, and the prevention of an arms race in outer space (PAROS).

The purpose of this conference series is to broaden and deepen the debate on the need to prevent an arms race in outer space and to foster space security for the future and, in line with UNIDIR’s mandate, 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 by UNIDIR on this issue in 2002, these conferences have received the financial and material support of a number of Member States, foundations and non-governmental organizations, demonstrating the broad and sustained political support for these discussions.

The conference comprised six panel discussions, each followed by question and answer sessions:

- The Threats—Today and Tomorrow;
- Ongoing Processes and Proposals—Next Steps;
- Incorporating Today’s Tools into Future Regimes;
- The Verification Challenge—The Art of the Possible;
- Cross-institutional Cooperation—Linking and Learning; and
- Engaging Critical Actors.

The conference convened in Geneva, Switzerland, at the Palais des Nations on 4–5 April 2011. The meeting was organized by UNIDIR with the assistance of Secure World Foundation and The Simons Foundation and was supported financially and materially by the Governments of Canada, the People’s Republic of China, the Russian Federation and the United States of America, as well as by the Secure World Foundation and The Simons Foundation. Conference participants included representatives from UN and CD member states, CD observers, non-governmental organizations and civil society.

The following is a report of the conference. The panellists are identified along with summaries of their presentations and the subsequent discussions.

## OPENING REMARKS

### **Sergei Ordzhonikidze**

Director-General of United Nations Office at Geneva

The conference was opened with remarks from Sergei Ordzhonikidze. He welcomed the opportunity to participate in another UNIDIR conference and pointed out that the international community would be celebrating the fiftieth anniversary of the first manned spaceflight the following week on 12 April 2011. That flight by Soviet cosmonaut Yuri Gagarin turned a new page in the history of civilization and opened space to humanity, Mr. Ordzhonikidze remarked. Today, outer space is indispensable to everyday life. It is used for telecommunications, banking, agricultural planning, natural resource protection and early warning of extreme environmental events. In addition, space technology is critically important to monitoring the pace and extent of global warming. Mr. Ordzhonikidze emphasized that while space assets are not a panacea for today's global challenges, their usage has, and will continue to have, a major role to play in enabling multilateral responses. As a consequence, it is more urgent than ever before that space remain a peaceful domain.

All states have an inalienable right to access outer space for research and peaceful use as the 1967 Outer Space Treaty (OST) dictates. Therefore, it is natural that space security should be their common goal. States must join their efforts in search of a way to consolidate space security and stability, because one depends critically on the other. The weaponization of space will trigger unpredictable consequences, similar to those at the onset of the nuclear era. Weapons deployment in outer space by one state will inevitably spark a chain reaction and risk a spiralling arms race both in space and on Earth, Mr. Ordzhonikidze warned. He reminded the audience that PAROS is one of the CD's four core agenda issues and has been included in all proposals since 1982 for the CD's Programme of Work. Further, there is a growing demand in the international community to see concrete measures taken to strengthen space security. The more we depend on space, the more we need space security.

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Mr. Ordzhonikidze pointed out that, lately, several states have tabled a number of proposals for preventive measures against the emergence of new, destabilizing weapons. In 2008, Russia and China officially submitted to the CD a draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT), which could provide a good basis for further discussions and possibly lead to eventual PAROS negotiations. Additionally, the General Assembly adopted resolution 65/68, which emphasized the need for transparency- and confidence-building measures (TCBMs). Mr. Ordzhonikidze concluded by expressing his hope that this conference would contribute to a balanced discussion of all tabled initiatives and help promote space security issues in the CD.

#### **Wang Qun**

Ambassador for Disarmament Affairs and Deputy Permanent Representative of the People's Republic of China to the United Nations Office at Geneva and Other International Organizations

Wang Qun began his remarks by acknowledging that UNIDIR has enabled the CD and its PAROS discussions through these annual space security conferences. In turn, the CD has made important contributions to safeguarding space security. Annual General Assembly resolutions have transformed space security into a concept with growing popular support. From 1985 to 1994, the ad hoc PAROS committee in the CD conducted discussions that laid the technical groundwork for possible formal negotiations. Ambassador Wang recognized that since 1995 the CD had been unable to conduct substantive discussions under the PAROS agenda item. However, he added that some CD members had nevertheless conducted a large amount of research and discussion on the subject, which lay a substantive foundation for any work the CD would do in the future.

Ambassador Wang highlighted that the importance of space grows every day. On the one hand, the ever increasing growth of space activities may engender a growing risk of an arms race and uncertainty in space security. On the other hand, even though the shortcomings of the existing legal regime are widely recognized, it has been very difficult to discuss the option of negotiating a new treaty. Ambassador Wang questioned how the international community could work through such a dilemma. He hoped that three issues might stimulate further discussion. First, he

argued that the CD should remain the primary forum for political, legal, technical and institutional discussions and for constructing any new legal instruments on the PAROS issue. He reminded the audience that the CD has a clear mandate as the sole forum for negotiating international arms control measures. Additionally, the CD is the most representative forum for such discussions and is home to more than 30 years of valuable expertise in related fields. He added that the CD is well equipped to negotiate any new legal instruments on outer space. Second, Ambassador Wang argued for the advancement of establishing rules for space behaviour in a pragmatic manner. As part of this effort, TCBMs can enhance trust, reduce accidents and errors, and regularize space activities. They can also be a useful supplement to any binding legal instrument aimed at preventing an arms race in space. Ambassador Wang emphasized that the best way to establish rules is through broadly participatory and representative TCBMs. The Code of Conduct for Outer Space Activities proposed by the European Union and the Canadian proposal in the CD has attracted great interest from many parties in regard to possible TCBMs. Further, the General Assembly resolution calling for the formation of a Group of Governmental Experts (GGE) will provide a highly authoritative forum for discussions on the subject. Third, Ambassador Wang called for the adoption of a varied and inclusive approach. The pursuit of a legally binding PAROS agreement and TCBMs are two complementary processes. Therefore, Ambassador Wang underlined, the international community cannot pursue one and avoid or lose sight of the other. He hopes that the two approaches will build on each other to reduce risk and enhance security and safety in space.

#### **Marius Grinius**

Ambassador and Permanent Representative of Canada to the United Nations and to the Conference on Disarmament

Marius Grinius began his remarks by establishing that the topic of space security is more relevant than ever as mankind's use of space has grown exponentially and the global community greatly depends on the sustainable and peaceful use of outer space. Yet, Ambassador Grinius highlighted, humanity's ability to ensure such continued use is challenged. That is the challenge the CD must face.

Ambassador Grinius mentioned that Canada has always supported space activities and planetary exploration missions as a way of expanding human

knowledge. The importance of space to Canada can be seen in its thriving commercial, civil, defence and university research programmes on space-related issues. Furthermore, the Canadian Space Agency is recognized worldwide for the quality of its projects and capacity to cooperate effectively with other agencies. The Canadian commercial space sector is a global leader in developing space robotics and satellite equipment. For these reasons and more, promoting the peaceful use of outer space is very important to Canada. As such, Canada has taken an active role in leading PAROS discussions at the CD.

Ambassador Grinius reminded that more work needs to be done in order to ensure that humanity is guaranteed peaceful and sustainable use of outer space. He acknowledged UNIDIR's valuable contribution to the work of the CD and the UN Committee on the Peaceful Uses of Outer Space (COPUOS) in bringing together relevant players. He concluded by stating that the Government of Canada is very pleased to support this conference and is sure that the ensuing discussions will advance work towards ensuring that all mankind benefits from the peaceful use of outer space.

## **PANEL 1**

### **THE THREATS—TODAY AND TOMORROW**

One of the biggest challenges in building future binding or non-binding regimes for space security is understanding the current threats and where technology is rapidly heading. The first panel aimed to shed light on those issues and began with a presentation from Mr. Lars Höstbeck, Deputy-Head of the Defence and Security Systems and Technology Division of the Swedish Defense Research Agency. Mr. Höstbeck presented on "Available and Emerging Weapons Technologies", which looked at the concept of space weapons, how they work and some possible and impossible examples.

Mr. Höstbeck first examined the concept of space weapons. He pointed out the oddness of the term, since people do not talk about "air weapons" or "sea weapons". The term "space weapons" is often used to refer to a variety of theoretical weapons systems with a range of capabilities. Such weapon systems can be divided into three categories defined by the relationship between launch platform and target: Earth-to-space, meaning



weapons based on Earth aimed at targets in space such as already tested and proven anti-satellite (ASAT) missiles; space-to-space, meaning weapons deployed in space and targeting other space objects; and space-to-Earth, meaning weapons deployed in space and aimed at targets on Earth.

These can be further divided by how a weapon achieves its desired effect and how it is launched. The easiest way to achieve desired effects is through kinetic energy. Such “hit-to-kill” weapons use direct contact with a target to inflict damage. Both the US and Chinese anti-satellite tests were based on this kinetic approach. Space weapons may also use explosives to inflict harm. However, one must remember that, because there is no atmosphere in space, explosives do not create shockwaves there. Therefore, a space weapon explosive must include pellets or fragments so that, when the warhead is detonated, they impact the nearby target. There are also no shockwaves from nuclear explosions in space, but the radiation emitted will cause considerable damage to space assets. A space weapon could also use directed energy through lasers or high-powered microwaves to achieve the desired effect. Space weapons can be launched via direct ascent from the ground, sea or air. This requires minimal energy and effort because the weapon only needs to reach its satellite target—it does not need to achieve orbit. The more difficult task is ensuring that the weapon is able to home in on its speeding target. Space weapons can also be launched co-orbitally, meaning the weapon is launched into orbit alongside its target. This approach requires more energy since the weapon must reach orbit and carry a warhead to damage the co-orbiting target, but such weapons could be deployed ahead of time and used later.

Mr. Höstbeck provided examples of space weapons from each category and identified the economic, technical and military feasibility of each system. For Earth-to-space systems, he looked at ground-based ASAT missiles and ground-based lasers. Ground-based ASATs require a medium-range ballistic missile, a homing device and a warhead—either hit-to-kill, explosive or directed energy—to take down its space-based target. These systems are economically, technically and militarily feasible and have already been demonstrated by a few states. Ground-based lasers require a large, fixed infrastructure and would consume an incredible amount of energy, but could attack a target without creating debris. By using a laser to dazzle a satellite’s sensor, one could disable the target without physically

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destroying it. Such a system would be very expensive, but is technically possible and may provide military advantage.

For space-to-space systems, Mr. Hstbeck discussed space-based anti-ballistic missiles and space-based lasers targeting space objects. The first system is best represented by the United States' "Star Wars"-era programme named Brilliant Pebbles. A space-based missile-defence system could double as an ASAT system, but would require large numbers of on-orbit interceptors and thus would be prohibitively expensive to deploy. And even though it may be technically possible, the military benefit is arguable because of the ease with which the system could be defeated by countermeasures, according to Mr. Hstbeck. The problem with the concept of a space-based laser is the size, as current laser systems require massive amounts of chemical fuel to power them. Existing launch capabilities could not handle the size and weight requirements. A space-based laser would also consume an incredible amount of energy that would somehow have to be replenished, and further it would have a low degree of coverage. In other words, space-based lasers make little sense, economically, technically and militarily. Lastly, Mr. Hstbeck discussed space-to-Earth systems, including kinetic energy rods and hypersonic space planes. Kinetic energy rods are non-explosive weapons dropped from a space-based platform to hit targets on Earth. Such a system faces huge technical challenges, would be extremely expensive and, if ever deployed, would be very vulnerable to attack. Hypersonic space planes, conversely, are slightly more possible in the near future. A space plane would be a platform and not a weapon itself—that is, a space plane could carry a multitude of payloads including weapons. Still, the technology is not mature at the moment.

Mr. Hstbeck concluded by emphasizing that the term space weapons is slightly misleading, in that there is not a homogeneous family of systems. There are many methods and types of systems that could be considered space weapons. Ground-based ASAT and anti-ballistic missile systems already exist, he stressed, and thus are the most urgent focus. In his opinion, space-based weapons systems are highly unlikely in the near future because they are prohibitively expensive, are founded on immature or unproven technology, and would be very vulnerable to attack. Thus, Mr. Hstbeck said, future discussions on the weaponization of space will need to focus on specific capabilities, rather than attempting to deal with the generic concept.

The next presentation was given jointly by Mr. Tal Dekel and Mr. Ram Levi from the Yuval Ne'eman Workshop for Science, Technology and Security at Tel Aviv University in Israel. Together, they presented on "National Capabilities and Programmes" and provided an overview of various states' current space abilities. Mr. Dekel began by quoting the *2010 Space Security Index* definition of space security: "the secure and sustainable access to, and use of, space and freedom from space-based threats". He noted that, based on their research, this definition of space security should be expanded to address all threats to space systems. The study's methodology was to perform a bottom-up analysis of recent space security events and then perform a top-down analysis of the official programmes and capabilities of a few spacefaring states.

Mr. Dekel began by summarizing the growing importance of space capabilities, the increasing number of states and actors in the "space club" and the vulnerability of space assets even without the threat of ASATs. He then provided a summary of recent, key space security events. In 2007, China tested a direct ascent, kinetic energy ASAT; in 2008, the United States used a ship-based missile to down a de-orbiting satellite—an event that, while not technically labelled an ASAT test, demonstrated de facto capabilities. These tests resulted in growing international concern about the weaponization of space. Another interesting incident that is less discussed from this security perspective is the alleged cyberattack in 1998 on ROSAT, a US–German–UK satellite. In September of that year, ROSAT turned toward the sun for no apparent reason causing permanent damage to its optical sensor and rendering the satellite useless. It is uncertain whether this event was caused by a cyberattack or by a system malfunction. Nevertheless, the US National Aeronautics and Space Administration (NASA) Office of Inspector General found that NASA ground systems had been breached, which could have been related to the ROSAT incident. Another space security event not often discussed was the May 2001 fire at a Russian ground control station. The fire damaged ground systems and led to a loss in control of four satellites, which Mr. Dekel emphasized was hazardous for other satellites. Similarly, in April 2010, commercial satellite operator Intelsat lost contact with its Galaxy 15 satellite. For several months, this satellite—which was still broadcasting—drifted uncontrollably through key orbits, thereby posing a threat to other space objects via both radio-frequency interference and potential collision. Further, in 2009, several major satellite broadcast stations were jammed for many months by systems based in Iran. Formal complaints were filed with the International

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Telecommunication Union (ITU), but the situation has not been resolved as the jamming has not been acknowledged by the Government of Iran. This raised costs significantly to the broadcasters and satellite owner–operators involved.

Mr. Dekel switched to discussing ASAT capabilities, which he defined as “a capability, developed for peaceful purposes, that can be easily modified to an ASAT”. His first example was the X-37B Orbital Test Vehicle, a space plane manufactured by Boeing for the United States military. The plane is intended to be a reusable space vehicle. The ASAT capabilities of the X-37B reside in its potential ability to host secret ASAT satellites, to manoeuvre in close proximity to other space assets and to use a directed energy payload against an object in space. Mr. Dekel’s second example was Orbital Express Space Infrastructure Servicing, which is expected to deploy in 2015 and is intended to service satellites on orbit. Its ASAT capabilities reside in its ability to rendezvous with, dock with and tow other space objects.

Mr. Ram Levi discussed national programmes and capabilities. Much of the technology under development or being deployed is dual-use and designed for peaceful purposes such as debris removal or broadcasting, but some systems could be said to be just one decision away from becoming ASATs. Jamming capabilities are most common and their use poses a serious threat; of particular concern is the potential for escalation in a crisis situation. Additionally, many states are developing cyberattack capabilities, which would represent a true threat to space systems.

In summarizing national programmes, Mr. Levi began with the United States, arguably the leading space power. The United States sees freedom of action in space as important to its military prowess in other domains, according to Mr. Levi. It is also the most reliant on highly integrated, and hence vulnerable, space capabilities. The United States invests heavily in space-related military research and development, including for capabilities to deny the use of space-based assets by adversaries. On the other hand, the United States is also a leader in collision prevention and, under the Obama administration, is now seeking an international code of responsible behaviour for all spacefaring states. Current US capabilities include the world’s largest space situational awareness (SSA) network, the aforementioned X-37B space plane, an early warning satellite network and cyber/electronic warfare capacity—and research is ongoing on airborne

and ground-based lasers, on-orbit servicing systems and space debris removal technologies.

The European Union is an emerging player in space security. Three EU-sanctioned reports indicated that Europe's security strategy is incomplete without a space component. Further, in 2004 and 2005, the European Commission called for a space security roadmap, though it has been made clear that the European Union should not contribute to the weaponization of space. Current EU policy places heavy emphasis on securing an independent European ability to access and use space. European capabilities include the development of SSA and space-based crisis-response architecture and the Galileo global navigation satellite system programme.

France also invests individually in various satellite applications including for communications, Earth observation and space debris detection. France opposes the transformation of space into a battlefield and as such has independently declared that it will not deploy weapons in space. With that said, France is a major player, equipped with ballistic missile capabilities, and is a nuclear-weapon state. It is currently developing a space-tracking radar system, which is set to begin operating in 2014.

Russia has a long history of space activity and is the second largest investor in military space capabilities. According to Mr. Levi, Russia views the growing US capability in space as evidence of a widening military gap between the two states. Additionally, Russia views space as a domain that enables strategic advantage through precision strike. It is currently investing in research and development for various space debris mitigation systems, including a reusable launch vehicle. Russia also has a low Earth orbit surveillance system based on radars placed around Russia and in other countries, an early warning surveillance system, proven kinetic ASAT capabilities, a ground-based laser and cyberattack capacity—all of which could be used to target satellites, according to Mr. Levi.

Unlike some other states, China believes that the weaponization of space is an inevitable development despite its long-held diplomatic stance in opposition of space weapons, Mr. Levi argued. The Chinese military structure recognizes the importance of space for achieving battlefield dominance and as such invests in counter-space research and development. Currently, Chinese capabilities include demonstrated kinetic

ASAT missiles and increasingly sophisticated jamming systems. China is also conducting research on lasers and electromagnetic pulse technologies that could be used against satellites.

Mr. Levi examined the Iranian programme last. He indicated that Iran desires to be the leading space power in the Middle East by 2020. However, Iran launched its first satellite only in 2009 and currently has limited launch capabilities. At the same time, according to Mr. Levi, it is a “leader” in satellite broadcast jamming.

In conclusion, Mr. Levi emphasized that all spacefaring states have ASAT capabilities. Additionally, intentional jamming and unintentional interference are real and current problems. Barriers to entry are low for these space security threats, which often means they are hard to detect and deter. If not addressed soon, these threats will continue to cause financial and operational damage. Finally, Mr. Levi highlighted the growing cyber threat. He pointed out that cyberattacks on ground systems are easier than many other satellite disruption techniques.

Mr. Emmet Fletcher, Head of the Space Situational Awareness, Space Surveillance, and Tracking Segment of the European Space Agency, presented on “Flying Blind: the Need for Multilateral Space Surveillance Capability”. He began by providing a brief survey of the many ways humanity relies on space. From navigation to telecommunications, from treaty verification to land surveys, space is increasingly incorporated into daily life. Mr. Fletcher then showed a graph of the growth of space objects and pointed to moments where growth had spiked, such as around the Iridium–Cosmos collision of February 2009. There are about 800 active satellites among the millions of space objects in orbit. Moreover, the quantity of these objects is only set to increase further.

Therein lies the central problem with space security, Mr. Fletcher argued. The quantity and growth of space debris pose a serious threat to the environment. Debris travels at incredible speeds such that even the smallest piece can cause serious damage upon impact with active space assets. For the estimated 20,000 objects of traceable debris (those greater than 10cm), a satellite would need to manoeuvre out of the way or else risk becoming inoperable. This size of debris is observable depending on altitude. For the hundreds of thousands of pieces of potentially traceable debris (those 1 to 10cm), a satellite might be shielded but, if impact

were made, the effect could be complete or partial loss. This size is only observable under optimal viewing conditions. Lastly, if a satellite were to collide with any of the millions of untraceable pieces of debris, it could face degradation or loss of its sensors and subsystems.

Mr. Fletcher then discussed possible solutions to such distressing circumstances. The first possible solution is prevention. There is a long history of different bodies producing recommendations on how to reduce the amount of debris and debris creation. For example, the Inter-Agency Space Debris Coordination Committee (IADC) was established in 1993, NASA issued its own Orbital Debris Mitigation Standard Practices in 1995 and China adopted its own debris mitigation guidelines in 2003. In 2007, the General Assembly officially adopted a version of the IADC's Mitigation Guidelines, which call for the following seven items: limit debris release during operations, minimize the potential for spacecraft and rocket body break-up, limit the probability of accidental collision on orbit, avoid intentional destruction and other harmful activities, minimize potential for post-mission break-up, limit the presence of spacecraft in low Earth orbit at the end of mission, and re-orbit satellites above the geostationary orbit at the end of mission. Mr. Fletcher also mentioned that the International Organization for Standardization (ISO) was set to release debris mitigation standards as well.

A second possible solution is surveillance and detection. If it is known where potentially damaging objects are, active satellites can move out of the way to avoid impact. Detection can be accomplished through radar, which offers good coverage of lower altitudes, high fidelity and rapid results. A radar SSA system would require both a so-called "fence" to detect objects, and tracking capabilities, but only a few sites are needed for full coverage. However, radars are expensive to develop, install and operate and their environmental effects must be taken into consideration, namely radio-frequency interference. Optical sensors can also facilitate detection. They provide good coverage for medium and high altitudes and medium to high fidelity. However, the results are slow and building a surveillance network of sensors is complex. Plus, a large number of sensors would be needed to provide full coverage. Conversely, they are cheap to develop, install and operate, but the environment can affect their performance—that is, optical telescopes cannot see through cloud cover. A third source of detection data is the payload operators themselves. Since they own and operate active satellites, they have the best information on

their location. However, this will only work for active space objects. It is a high-fidelity, low-cost option, but involves legal issues over the sharing of proprietary information.

Mr. Fletcher presented next on current capabilities and stated that various detection systems already exist. The US Space Surveillance Network is the largest, with comprehensive coverage of traceable items in low Earth orbit. However, it suffers from coverage gaps, especially in equatorial orbits, and may suffer from cost constraints in the future. The Russian Space Surveillance System has a well-developed low Earth orbit section, but it is strictly military. Higher orbits are covered by the Russian-sponsored ISON network, which relies on collaboration among scientific telescopes around the world. China has begun phased development for low Earth orbit coverage, but faces geographical restrictions that will inhibit full coverage. Finally, Europe has only one dedicated radar system for space surveillance, but its optical coverage in medium to high orbits is well developed. The European Union has announced its intent to develop autonomous SSA capabilities in the near future.

No single system is ideal, Mr. Fletcher argued, which is why cooperation is key. He highlighted the gaps in each of the aforementioned systems and the fact that further surveillance capabilities will come at a very high cost. Moreover, there is a lack of confidence when data comes from only one source. Alternatively, a multilateral system enables confidence-building. Design errors are not replicated with such a system and collision warnings can be corroborated against multiple sources. A multilateral system also ensures better performance. It will have higher detection frequency, will reduce the workload of any single system and can provide geographical diversity, which ensures fuller coverage. Additionally, such a system would come at reduced cost. The burden of tracking everything will be spread out over multiple actors and current redundancies can be better managed. Lastly, a multilateral system ensures lower costs of entry for developing states eager to join the "space club."

A question was asked about the difference between the IADC Mitigation Guidelines and the upcoming ISO guidelines. It was mentioned that the ISO standards had already been issued, under the number 24113. The IADC brings together national space agencies to coordinate research. No other actors are involved. Their guidelines are meant to be implemented at state level if they are found to be sufficient. The ISO standards, on the



other hand, were developed by academia, industry and governments. They can be used as binding requirements in licensing, for example, and, in this sense, are very useful in commercial and government operations.

Another participant asked if a hypersonic space plane might become a weapon if it entered orbit. If it enters orbit, it is no more a weapon than a satellite simply because it is in orbit. The question is what payloads it carries and from where (in orbit or in airspace) it might release or use any weapon-type payload. However, this area is still unexplored and should be better understood if the discussion on space security is to move forward.

## **PANEL 2**

### **ONGOING PROCESSES AND PROPOSALS—NEXT STEPS**

The second panel began with a presentation from Mr. Sergey Koshelev, Deputy Director of the Department of Security and Disarmament Affairs at the Russian Ministry of Foreign Affairs. His presentation was entitled “Using the 2012 GGE to Forward the Process”. He commenced his remarks by noting that he had participated in the first UNIDIR space security conference. Since then, the event has grown and more representatives from participating states attend, particularly from the United States. He indicated that Russia was ready to support UNIDIR in all its endeavours to reach the goal of weapons-free space.

Mr. Koshelev then turned to the issue of TCBMs. He mentioned that the proposed PPWT was designed to prevent a worst-case scenario. TCBMs are important elements of any effort to prevent the placement of weapons in outer space. They are not at odds with the PPWT. On the contrary, they are part of the proposed treaty negotiations. Russia strongly believes that the pursuit of TCBMs could facilitate negotiations on the PPWT. Increased predictability of military space activities through such measures could reduce tensions in the space domain and prevent future conflict. Mr. Koshelev acknowledged that the development of formal verification measures for the PPWT would be a complex task. As a result, Russia and China proposed that these measures be added later as an annex to the original treaty. Meanwhile, TCBMs will compensate for the interim lack of verification mechanisms.

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China, Russia and other states have introduced relevant General Assembly resolutions that call for the further development of TCBMs, for which 2010 was a threshold year. The General Assembly First Committee successfully completed its five-year cycle of work, during which various states submitted proposals to the Secretary-General for further strengthening of TCBMs. It was then proposed that additional work on TCBMs be carried out in a GGE. Resolution 65/68, which supports the establishment of the GGE, passed with an overwhelming majority of votes in December 2010.

The international community is now faced with the question of how to structure the GGE work plan. The priority should be placed on defining the GGE's goals, agenda and programme of work. These should be based on appropriate and realistic priorities and consensus and should reflect continuity with the 1991–1993 GGE while accounting for technological changes. The final GGE document could form the basis of a subsequent international agreement on TCBMs. The UN Secretariat has scheduled three GGE working sessions. Two will take place in New York in 2012 and 2013 and the third will take place in Geneva in 2013. Each session will consist of ten meetings over five days. In light of this time limitation, Mr. Koshelev suggested that all states prepare considerably for these meetings so that they can be as productive as possible. As part of this preparation, he called for a GGE subgroup of experts to meet, study existing TCBM proposals and the 1993 GGE document, and compile a possible list of items for the official GGE discussions in 2012 and 2013.

Mr. Koshelev provided an overview of possible TCBMs, which can be divided into several categories: measures aimed at enhancing transparency of outer space programmes, measures aimed at expansion of information on objects in orbit, and measures related to the rules of behaviour in outer space activities. The GGE should judge each category carefully based on criteria of usefulness, applicability and effectiveness. This information could be compiled in a sort of TCBM catalogue, which could in turn serve as the basis for a future international agreement.

Mr. Koshelev also explored how the GGE related to the current proposal for an international Code of Conduct on Outer Space Activities. These activities both deal with TCBMs for outer space. The Code of Conduct includes some of these measures in its fourth and fifth chapters. The GGE document could serve as a tool that outlines how each state could implement space TCBMs. If a state does not have a space programme,

it could still participate in relevant workshops and demonstrations. In this sense, such a document could serve as a component of a code of conduct. In its turn, the draft Code of Conduct could undergo serious multilateral expert consideration within the GGE. Then, it could be formally represented to the international community as an instrument prepared under the auspices of the United Nations, thereby laying a solid foundation for its widespread adoption and implementation. Mr. Koshelev concluded by expressing his confidence that the GGE would positively contribute to space security and stability.

Next, Mr. Frank Rose, Deputy Assistant Secretary for Space and Defense Policy at the US Department of State, presented on "Strengthening Stability in Space". He expressed his hope that the conference would help inform the international community's efforts to strengthen security and stability in space. He also mentioned the new US National Space Policy, which was released in 2010. Consistent with President Obama's guidelines in the Policy the United States is pursuing measures to strengthen space security and stability. His remarks focused on how shared SSA and TCBMs might help achieve that.

He began by asking why SSA is important to space security. He pointed out that a long-standing principle of US space policy is that all states have the right to explore and use space for peaceful purposes and for the benefit of all humanity in accordance with international law. However, strengthening space stability fundamentally depends on knowing and understanding who is using the space environment, for what purposes and under what environmental conditions. The current National Space Policy calls for the United States to collaborate with other states, the private sector and intergovernmental organizations to improve SSA. Having this information as early and accurately as possible is critical for a number of reasons. First, it is critical for human spaceflight safety. Second, it is in the interest of the United States, its allies and all states to be able to detect, identify and attribute actions in space that are contrary to responsible and peaceful use. And third, given humanity's growing dependence on space-derived information, it is critical to the functioning of global economies.

However, simply knowing this information is insufficient. It is critical that the international community knows what to do with that vital information. In other words, how can that information be made actionable? The risks of an increasingly congested outer space environment and the growing

complexities of operating there safely and responsibly lead to the challenge of collision avoidance. One way that international cooperation enhances SSA is the information exchange between satellite owners and operators to prevent collisions. The United States provides notification to other governments and commercial satellite operators of potentially hazardous conjunctions between orbiting objects. The US State Department also plays a crucial role in this activity because international cooperation is necessary to ensure robust situational awareness of the space environment since no one state has the resources to do this alone. The US State Department continues to be extremely supportive of US Strategic Command's efforts to establish SSA sharing agreements with foreign satellite operators and to facilitate rapid notifications on potential space hazards.

Moreover, Mr. Rose noted that the United States is constantly seeking to improve its ability to share information with other spacefaring states as well as with commercial sector partners. In fact, across the whole of US government, numerous multi- and bilateral SSA engagements are taking place. For example, the United States is collaborating with its friends and allies in Europe as they consider developing their own SSA architecture. The US Department of Defense is working with experts from the European union and the European Space Agency to ensure that current US SSA systems can coordinate with the planned European systems to provide a more comprehensive picture of the space environment. This will lead to enhanced security, safety and stability of the space domain for all. Furthermore, the US Department of Defense has signed bilateral SSA statements of principles with Canada, France and Australia. In looking ahead, the United States also sees opportunities for cooperation on SSA with other states around the globe. Mr. Rose emphasized that SSA benefits all responsible spacefaring states.

Mr. Rose then mentioned another challenge, that of promoting responsible and peaceful behaviour in space. Meeting this challenge depends not only on taking positive steps, both unilaterally and multilaterally, to enhance the sustainability of space activities, but also conducting those activities in an open and transparent manner. Upon their implementation, TCBMs also have the potential to enhance knowledge of the space environment, thereby strengthening security and stability in space. For instance, the United States is continuing to consult with the European Union on its initiative to develop an international Code of Conduct for Outer Space Activities. Mr. Rose stated that the United States hoped to make a decision

in the near term as to whether it could sign on to the Code, including what, if any, modifications would be necessary.

An example of where the Code of Conduct could contribute to shared SSA is its political commitment to provide notifications in a timely manner of malfunctions that might place space objects at risk, as well as any accidents or collisions that might have taken place. The United States is already following such practices, for example when it promptly notified Russia through diplomatic channels of the Iridium–Cosmos collision in February 2009. This experience contributed to ongoing dialogue between the United States and Russia on developing additional concrete and pragmatic bilateral TCBMs that would enhance spaceflight safety. Non-legally binding measures such as the proposed Code could build on existing practices, as well as on US and allied SSA capabilities, by mitigating the risk of mishaps, misperceptions and mistrust.

Mr. Rose also mentioned another initiative that could strengthen space security and stability, the multi-year study of “long-term sustainability of space activities” within the Scientific and Technical Sub-Committee of COPUOS. This effort would be forming an experts group to address SSA and space operations. In addition, a separate experts group would examine space weather, which is also an important aspect of SSA. The United States is hopeful that this effort will lead to the formation of voluntary “best practice guidelines”, which would help reduce operational risks to all space systems. In addition to drawing on the expertise of government experts, this working group would also draw upon the background, experience and best practices that have been developed by commercial satellite operators.

In conclusion, Mr. Rose reiterated that SSA is essential to strengthening security and stability in space and sustainability of space activities. To this end, the United States is striving to improve its ability to monitor, track and provide notifications regarding space objects. However, everyone’s picture of the space environment is greatly enhanced through international cooperation and shared SSA. Furthermore, strengthening security and stability in space is in everyone’s interests. It can be achieved through pursuing TCBMs that promote responsible behaviour and the peaceful use of space. Examples of this cooperation include initiatives such as the European Union’s proposal for an international Code of Conduct and the COPUOS agenda item on long-term sustainability. Such cooperation with

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established and emerging members of the spacefaring community and with the private sector will help to preserve the space environment for the benefit of all states and future generations.

Mr. Zhang Ze, Deputy Director at the Chinese Ministry of Foreign Affairs, presented on the topic of “Deepening Discussions on the PPWT” and summarized how past events have led to the current draft treaty. He began by giving a brief history of PAROS in the CD. It was first introduced to the Conference in 1981 by General Assembly resolution 36/97C. The following year, it was listed as a CD agenda item. From 1985 to 1994, there was an ad hoc committee on PAROS in the CD that produced 10 annual reports. Mr. Zhang acknowledged the contribution made by this ad hoc committee to deepening discussions on PAROS. In spite of the stalemate in the CD that began in 1995, discussions have continued on PAROS. In addition, many states launched useful initiatives for enhancing space security.

Mr. Zhang then looked at the recent evolution of PAROS efforts in the CD. In 2000 China issued a position paper (CD /1606) that outlined: principles not to test, deploy or use weapons, weapon systems or their components in outer space; clear definitions on “outer space”, “space weapons”, “weapons systems” and “components of weapons systems”; and the potential for verification mechanisms. China issued further possible elements in 2001, including an elaboration of the obligations that might be stipulated in a PAROS agreement. These were described as the “Four Nots”. This paper (CD/1645) did not provide a definition for “space weapons”, based on the recognition that doing so was impossible due to the dual-use nature of space technology. It also stated that further consideration and development of verification measures were needed. Further thoughts on these ideas were put forth in 2002 by China, Russia and other states and in 2006 and 2007 by Russia and China. In 2006, CD/1778 highlighted the importance of confidence-building measures, including those aimed at enhancing transparency and the expansion of information on outer space objects and rules of conduct for space activities. These measures could be carried out in various ways, including through information exchange, notifications, consultations and thematic workshops. Also that year, CD/1781 examined the issue of verification. It divided space verification into two categories: remote sensing surveys and on-site inspections. Additionally, CD/1781 concluded that the inclusion of verification measures in arms control treaties is usually weighed against political acceptability, technical feasibility and financial viability.

Mr. Zhang pointed out that a space verification regime might be politically unappealing since it would require the exposure of sensitive national security information. He also stated that it would require cutting edge technologies that are not readily available and are likely very expensive to implement.

Finally, in 2008, after extensive consultations with concerned states, China and Russia jointly issued the draft PPWT. The proposed treaty is based on all of these evolutionary efforts. Article II of the PPWT defines the basic treaty obligations. This provision is similar to the basic obligations outlined in CD/1669. The PPWT goes further to clarify the term “use of force” or “threat of use of force.” Finally, article VI of the PPWT leaves room for TCBMs and future verification measures. Mr. Zhang mentioned that additional efforts towards PAROS were made alongside the CD, including in General Assembly resolutions, discussions in other international bodies like COPUOS and the ITU, UNIDIR’s annual space security conference, which China has supported for many years, and bilateral consultations.

Mr. Zhang called attention to some major findings about PAROS based on these extensive, decade-long efforts. First and foremost, there is no doubt about the necessity for a PAROS treaty. Space is increasingly militarized and recent demonstrations of military capability in space show that weaponization is approaching. The existing treaty regime cannot prevent this from happening. Fortunately, an overwhelming majority of states support the adoption of a new, legally binding treaty that addresses this threat. He also mentioned that there are many different kinds of threats to space security. They can be solved through different approaches, which could be pursued in parallel and complement each other. However, he made it clear that a new treaty on PAROS could and would serve as a basis for other soft law. Without such a foundation, soft law will be useless. He also reminded that a legally binding instrument would represent the best confidence-building measure of all. Finally, years of discussion have changed the mind of the international community on the feasibility of a new PAROS treaty. Initially, the international community approached it sceptically, like other traditional arms control efforts. However, a different approach is needed in four areas: technical, legal, political and financial. For example, it may not be feasible to define and control space weapons, but it is possible to define and ban certain actions or behaviours.

Mr. Zhang argued that the PPWT would be a basis for future steps towards space security and PAROS. By adopting the PPWT, the CD could accomplish three goals: no weapons placed in outer space, no use of force against outer space objects and no threat of use of force. Combined with other soft law approaches, the PPWT could make space more secure and sustainable for the future. He then outlined some steps forward. Further substantive discussions were set to take place in the CD, but he emphasized that a negotiating mandate for the PPWT would be most preferable. In addition, he advised against setting unreasonable preconditions for negotiations. However, Russia and China would be open to revising the PPWT based on equitable and transparent discussions. Mr. Zhang expressed his optimistic anticipation for the GGE, future international and regional seminars, and bilateral consultations. He concluded by emphasizing that the CD should move forward based on its past experiences and not duplicate work already done before. He hoped that the CD could find a way to move past its disputes and agree on a PAROS treaty as has been called for by over 30 General Assembly resolutions.

One participant asked whether the United States viewed TCBMs as an alternative to a legally binding instrument. The United States sees TCBMs as a first step in laying down a much-needed foundation of trust and transparency. It was mentioned that TCBMs also preceded the OST.

Another participant pointed out that current space security negotiations focus on the prevention of space weaponization and conflict. If the CD and the international community continue to delay these negotiations, they will be forced to deal instead with the control of weaponization and hostilities in space. This particular participant was optimistic because, when the PPWT was first proposed, the United States presented a long list of complaints. That list seems to have diminished. The participant encouraged the United States to consider discussing the proposal and re-emphasized China's and Russia's willingness to discuss draft revisions. The concerns of the United States with the PPWT were reiterated, and it was stated that the United States sees the Code of Conduct as the next best step.

One participant referred to the United States concerns about the PPWT draft not including ground-to-space kinetic ASATs and not being effectively verifiable. It was explained that such weapons go through a process of



research, development, testing and use against an adversary. While the first two elements are not effectively verifiable, the latter are easily so and most states currently have the technology to do so. The participant wondered if the United States would reconsider the PPWT if the draft were amended to include those two verifiable elements for kinetic ASATs. It was pointed out that the United States is also concerned with the PPWT on the issue of breakout capability. In order for the United States to be comfortable with the draft treaty, this would need to be addressed as well. It was also pointed out that the US ratification process for legally binding agreements is particularly difficult. The US Senate would be unlikely to consider any treaty that was not perceived as effectively verifiable.

Another participant questioned how the PPWT might contribute to space security from the standpoint of the broader political context. It was pointed out that space security reflects the security dynamic on Earth. The current draft of the PPWT seems to largely ignore the changing political and security dynamic on Earth. In that sense, how could the PPWT add to the security dynamic? This open-ended question is extremely difficult to answer. How does any arms control, non-proliferation or disarmament treaty contribute to international security? China and Russia are open to discussing how the draft PPWT might enhance the security of all in space and on Earth. Further, it was commented that the PPWT is a preventive measure, which is preferable to measures that aim to control events after they have occurred. Also, as a preventive measure, it could forestall an arms race in space and enhance international transparency. Finally, it was observed that the PPWT aims to strike a balance between preventing space conflict, protecting the inherent right of states to self-defence and enabling states to continue developing military capabilities—if certain major players are unwilling to discuss the treaty, there will be a stalemate.

### **PANEL 3**

#### **INCORPORATING TODAY'S TOOLS INTO FUTURE REGIMES**

Steven Freeland, Professor of International Law at the University of Western Sydney in Australia, opened the third panel with his presentation on “International Humanitarian Law and Codifying Constraints on Space Warfare”. Before explaining how international humanitarian law (IHL) relates to space, Mr. Freeland summarized some legal aspects of the space domain. From the onset, outer space was designated a unique

environment from a legal perspective. Along with that designation came some relatively uncontroversial fundamental principles about the domain's legality, such as freedom of access and non-appropriation principles. However, it is important to understand that there is still no legal definition of outer space. Many states have adopted different demarcation lines for where sovereign airspace ends and outer space begins. In Mr. Freeland's opinion, establishing an internationally accepted definition for outer space will facilitate progress on space security debates.

There are many legal instruments that apply to space, Mr. Freeland stated. These include soft law approaches in General Assembly resolutions and TCBMs; national laws and regulations in some 35 states; other treaties, regimes and regional and international agreements that address space; and customary international law. So while there are many legal instruments for space, law has been unable to keep up with the speed of technological progress, as is the case in many technical domains. For example, the OST was signed some 10 years after the launch of Sputnik and the space age. While it took some time to negotiate, the OST does lay out fundamental principles of international law for outer space. Importantly, it states that space activities must be conducted in accordance with international law and specifically mentions the UN Charter. Moreover, it restricts the placement of weapons of mass destruction in space, though it does not specifically limit their use. Finally, the OST establishes the peaceful purposes doctrine, which states that space should be set aside for peaceful uses. The meaning of this doctrine has been debated for decades, especially since space has been used for military purposes for nearly as long. Every military conflict in the past few decades has increasingly relied on space capabilities. This may contradict the fundamental principles of the OST, but that is the accepted reality. Further, governments and militaries increasingly depend on commercial space assets to conduct their operations. Thus, space is characterized by dual-use systems, which complicates the application of IHL as in other domains.

If humanity is growing ever more dependent on space, is a space conflict inevitable? Since the domain is characterized by a lack of trust and transparency, Mr. Freeland believes that states will continue to expand their military space capabilities. He acknowledged that there are several soft law initiatives on the table to increase space security and reduce the risk of space conflict. However, while soft law can be an important stepping stone, it is no substitute for binding international agreements. Moreover,

there is always the risk that the international community might feel satisfied with non-binding arrangements when the ultimate goal should be a treaty.

Since existing space law is insufficient to govern a possible space conflict, Mr. Freeland looked at how other extant international law might fill in the gaps. Specifically, he examined how IHL might apply to space conflict. IHL essentially governs the means and methods of warfare, and its principles would apply to space based on the OST, which states that international law must be respected in outer space. Further, IHL principles are not limited territorially. They apply to both the location where hostilities are carried out and where their effects are felt, which is relevant for passive military applications in space. If space became an active theatre of war, other main IHL principles would apply as well. These principles are simple in theory, but always difficult to apply. The first principle is distinction and demands that militaries distinguish between military and civilian targets. The second principle requires that, even if a legitimate target is located, it must serve a direct military advantage if attacked. The third principle is proportionality, which is the most complex of all. Even when the first two requirements are satisfied, the advantage gained by an attack must be proportionate to the damage caused by that attack.

Mr. Freeland acknowledged that these principles are widely accepted and understood, but questioned if they are applicable to space hostilities. He focused on whether satellites would be a legitimate target in war. Given the advanced military utilization of many satellites, the demonstrated ability to incapacitate and destroy satellites on the part of more than one state, the clear strategic advantage to be gained in doing so, and the principles of IHL, one could theoretically assume that satellites are a legitimate military target. This is frightening from a debris-creation perspective, but also from the dual-use standpoint. What would be the effect of targeting a GPS or remote sensing satellite? Entire regions, countries and sectors are wholly dependent on unimpeded access to space technology for daily operations.

Mr. Freeland concluded by summarizing some current issues. Space technology is already used to conduct armed conflict and there is an increasing likelihood that space will become a theatre of war. However, every state is highly dependent on space assets for military and non-military uses. Yet, it appears that should a space conflict arise, these assets could become legitimate military targets. Problematically, it is not clear how *jus in*

*bello* principles would be applied in this situation. Therefore, Mr. Freeland argued for establishing more specific standards for space activities. The international community needs to work towards a comprehensive framework to govern outer space. Such a framework will need to clearly define the domain and what activities are permissible there. It will need to explore the meaning of “peaceful purposes” and should adhere to the humanitarian aspects of space activities. Finally, in his opinion, the pursuit of norms, TCBMs and soft law should continue, but must remain part of an overall strategy to establish a binding agreement.

The next presentation was entitled “Diplomatic Options Reinforcing Outer Space Security”, delivered by Ambassador Paul Meyer of The Simons Foundation. He began by referring to diplomacy as the art of the possible. Most diplomatic practitioners tend towards pragmatism and make the most of any given situation by considering the actors and elements at play. This is especially the case in multilateral relations. However, what is perceived to be possible can change rapidly. Such changes in outlook are the result of significant external events that alter threat perceptions and, thus, perceptions of what is possible in international relations.

However, this has not necessarily been the case for space. Several recent significant events have demonstrated the need for an expanded and strengthened space regime. In spite of this, the regime has not changed significantly since the OST was signed in 1967. One possible explanation for such stagnancy is that some may believe the current regime is sufficient, as did the United States under President George W. Bush. Ambassador Meyer reminded the audience that this belief was not shared by the international community generally. With the exception of Israel and the United States, UN Member States have repeatedly called for additional international measures in pursuit of PAROS and space sustainability. The First Committee of the General Assembly adopts annually the PAROS resolution that generates almost universal support for six elements: the belief that through PAROS the world could avert a grave threat to international peace and security, the view that confidence-building measures are important means of achieving PAROS, the recognition that the current space regime does not guarantee PAROS so it should be reinforced, the necessity for additional measures with appropriate and effective verification means, the call to avoid any action contrary to PAROS, and an invitation to the CD to establish a working group on PAROS. These elements represent the current international policy guidance on space security and are endorsed

by virtually all UN Member States. Clearly, the international community does not deem the current space regime sufficient and calls for it to be enhanced, reinforced and improved.

These resolutions are supplemented by a Russian-led initiative to elicit concrete proposals on TCBMs, which has also enjoyed widespread support. Several TCBMs have been proposed under this resolution. Further, this year's related resolution authorized the creation of a GGE in 2012 to consider the topic and report back to the General Assembly the following year. Ambassador Meyer mentioned that this represents the first step in many years to operationalize the general support expressed in the United Nations for space TCBMs as part of the PAROS strategy. Nonetheless, since GGEs are consensus-based bodies, there will need to be a true convergence of views among the experts for any recommendations to emerge from this effort. Should recommendations emerge, Ambassador Meyer added, it may require a change in the position of the leading space power, the United States. While official US positions on space security have moved in a positive direction, from outright opposition to mere abstention on the PAROS resolution, they have not been aligned with international opinion.

If the general policy line on space security expressed by the international community is clear, the process for its implementation is not. Ideally, the CD would be the venue for negotiating further space security measures. Unfortunately, because of deadlock, the CD has not been able to undertake any official work on PAROS for some 16 years. Ambassador Meyer added that there had been some interesting proposals and discussions on space security at the CD, but they were not part of any authorized or sustained process of negotiation or consideration. Given the prolonged blockage at the CD, there is real concern that the current "vicious cycle" on PAROS, whereby the General Assembly states that work should be undertaken and then assigns that work to a dysfunctional body, should not be perpetuated. The demonstration of destructive ASAT capabilities by China in 2007 and the United States in 2008, as well as the Iridium–Cosmos collision in 2009, have raised anxiety about the preservation of a peaceful space environment and have increased interest in pursuing diplomatic solutions.

Ambassador Meyer then asked what are the most likely venues and proposals for gaining traction on space security if not the CD. He presented three options: the PPWT, the European Union's proposed Code of Conduct, and other TCBMs. The PPWT is, at present, the only

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draft space security treaty officially before the international community. Its co-sponsors, Russia and China, have argued that it represents the best way to ensure the non-weaponization of space and would like to see work commence on it in the CD as soon as possible. Criticisms of the draft treaty have included its lack of constraints on ground-based systems and the absence of verification provisions. Moreover, China's 2007 ASAT test called into question its credibility as a proponent of space non-weaponization. Some interpreted the ASAT test as a warning that, in the absence of space arms control, these damaging actions could become more common in the future. This type of agreement, if not its exact content, remains the preferred classic option for those favouring legally binding measures. Neither Russia nor China has yet suggested that the draft treaty be negotiated outside the CD. Russia seems more open to the possibility than China. If one begins to advocate for negotiating the treaty in an alternative forum, it could break up the Sino-Russian partnership on space security. Ambassador Meyer recalled that other ways of realizing a ban on space weaponization had been suggested in the past, including adding a Protocol to the OST.

Ambassador Meyer then turned to the International Code of Conduct for Outer Space Activities proposed by the European Union. After extensive consultations, the European Union adopted a draft Code of Conduct for Outer Space Activities in December 2008 as a basis for further discussion with external partners. It has since released a revised version and has mentioned the possibility of convening a diplomatic, multilateral conference at which states would be invited to sign the Code. Meyer noted that the European Union has not officially submitted the Code to the CD and its suggestion of an independent diplomatic conference indicates its desire to work outside the CD. The Code is a deliberately modest, political text that would encourage greater cooperation among states on the use of space. The voluntary measures espoused in the Code are of a general nature and to a large extent simply reaffirm existing international norms. The Code emphasizes safe space operations and applies to civilian and military activity in space. Some relatively "soft" TCBMs are included in the Code. Ambassador Meyer added that US officials have recently stated that they are seriously considering the Code. The political nature of the Code and its relatively modest provisions will make it attractive in some quarters as a largely symbolic gesture uncomplicated by ratification requirements. However, the lack of real constraining measures, the "made in the European Union" label, and the parallel with The Hague Code of

Conduct on Ballistic Missiles and its unsatisfactory record of compliance may leave other states questioning whether the Code is the right vehicle for advancing multilateral space security goals.

Lastly, Ambassador Meyer discussed other TCBMs. Russia has been at the forefront of this effort and has made several proposals of its own. Many overlap with the EU Code in terms of notification and information exchange, although some go further, such as exchanges on “foreseeable dangerous situations in outer space” and the invitation of observers to spacecraft launches. Ambassador Meyer noted that while the Chinese have stressed that TCBMs are no substitute for a non-weaponization treaty, Russia has not been so categorical. Its leadership on TCBMs suggests Russia may be willing to settle for agreement on TCBMs as an initial step towards achieving a more collaborative space security regime.

Ambassador Meyer also noted that Canada had contributed to the debate by submitting working papers to the CD in 2007 and 2009. In the earlier paper, Canada proposed that states make better use of the confidence-building measures contained in existing accords such as the OST and the Hague Code of Conduct, a moratorium on ASAT tests be established, and multilateral SSA be conducted through a monitoring centre along the lines of the earlier French proposal for UNITRACE (United Nations International Trajectory Centre). In the 2009 paper Canada suggested that states agree to some specific security pledges—namely, not to place weapons in outer space, not to engage in destructive ASAT testing and not to use a satellite as a weapon. These ideas were seen to represent a middle ground between the PPWT and the softer Code of Conduct. The Canadian ideas were framed as “pledges” and explicitly referred to similar assurances already given by Russia, the United Kingdom and the United State. However, it was also noted that, if agreed upon and implemented satisfactorily, these pledges could graduate from a voluntary to a more mandatory status.

These three forms of proposals—a legal ban on space weapons, a voluntary code of responsible behaviour and some type of security-specific TCBMs—represent the principal options for multilateral diplomatic action in the near term. As the principal spacefaring nation, whatever position is adopted by the United States will be decisive in determining which, if any, of the above channels will be pursued. The Obama administration has signalled a preference for TCBMs over treaty-based arms control. As

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such, a US endorsement of the Code of Conduct could be seen as a sign of re-engagement in multilateral space security cooperation. Ambassador Meyer added that although such a modest step would disappoint those supporting a more substantial agreement, the United States may believe that the pursuit of bilateral TCBMs with Russia and China could allay the principal concerns of these two key space powers. Ambassador Meyer concluded by arguing that whatever step the United States ultimately took, it would be pushing on an open door internationally. The international community has demonstrated its desire to see tangible action taken on PAROS before this increasingly important environment is compromised through the introduction of weapons or the initiation of armed conflict in space.

The last presentation of the third panel was on “Lessons from Other Legal Regimes”. Michael Krepon, President Emeritus of the Henry L. Stimson Center, presented on this topic. He began by acknowledging that outer space is a demanding domain in which to operate and warned that it could worsen if states do not cooperate with each other. He indicated that the international community faces an important crossroads defined by the growing potential for cooperation on one hand and growing friction on the other. The path followed now will have lasting effects on the space environment and humanity’s ability to operate there. Mr. Krepon also mentioned that, like Mr. Koshelev, he has been attending UNIDIR’s annual space security conference since its inception in 2002.

Mr. Krepon pointed out that ambitious treaties in the domain of space security are rare. The OST is more than four decades old. The international community has not considered any instrument as ambitious until now, with the PPWT, which is even more ambitious than the OST. Even in the absence of binding treaties, norms and “rules of the road” can evolve into customary practice and form the basis for a legally binding regime. Such norms establish standards, set expectations and clarify responsible and irresponsible behaviour. Without such rules, there can be no definitive rule breakers. If these norms are practiced consistently by individual states reflecting their own self-interest and are incorporated into national laws and regulations, they could become customary international law. If enough states do this, the norms become codes of conduct with international standing that warrant eventual treaty codification, as in the cases of the nuclear, biological and chemical weapons regimes.



However, even if this evolution fails to occur, norm-setting can help to order and organize potentially chaotic domains. The OST established important norms, though they are not fully formed. These treaty principles were in fact preceded by soft law in the form of two UN resolutions in 1963. Mr. Krepon argued that the lesson learned from the OST is that UN resolutions have and can continue to facilitate norm- and treaty-building. Unfortunately, the norms found in the OST are insufficient and do not reflect the nature of current space activities. There are considerably more states involved in space activities, more uses for the domain, more debris and more problems—none of which were reflected in the OST. Therefore, the international community needs new norms for outer space.

There are important linkages between space security and the nuclear regime. First, the strategic space environment directly affects and reflects the Earth-based strategic environment. Second, elements of the nuclear regime impact space as well. For example, certain test ban treaties protect the space domain and the Strategic Arms Reduction Talks (START) treaties affirm the principle of no harmful interference with space assets and verify compliance. Moreover, the US-enabled expiration of the Anti-Ballistic Missile Treaty is problematic for the space environment and has complicated strategic dialogue between the United States and Russia. In Mr. Krepon's opinion, it is unlikely that the treaty will be resurrected given the current political environment in the United States and nigh impossible that something more ambitious would materialize. Third, like the nuclear regime, banning dual-use technology is impractical and banning the offensive application of such technology cannot be prevented without invasive on-site inspections.

Mr. Krepon then turned to the CD. Since the CD operates by consensus and is currently at a political impasse, norm-building must occur instead of creating new binding instruments in order to enhance space security in the near or intermediate term. Norm-building is not a substitute for binding measures; rather, it is a supplement. In fact, there are several cases where other diplomatic instruments were utilized to strengthen norms of responsible behaviour. The Incidents at Sea Agreement between the United States and the Soviet Union established norms for naval vessels and aircraft in close proximity. This model of non-treaty agreement through executive order has served both capitals well. Since its inception nearly 40 years ago, it has been adopted by 30 other navies. In fact, its lack of rules

of the road for responsible military behaviour makes outer space unusual in comparison to the other global domains.

In conclusion, Mr. Krepon stated that the international community is at a critical juncture in terms of space security. It can choose to enhance international cooperation or choose to risk growing competition. Treaty regimes are partial and imperfect because they are difficult to negotiate and must secure ratification. Instead, three norms in particular should be immediately strengthened by any possible means: non-interference, debris mitigation and space traffic management.

A question was asked about the emergence of norms in commercial and military sectors and how it compares to progress made in the diplomatic realm. It was stated that norm-building in the commercial and military sectors is far more advanced and that diplomacy lags behind. In the military realm, most norms rely on a sort of tacit understanding. If someone engages in provocative actions in space, others respond in a manner that is noticeable to the provocateur. Further, there has been considerable military restraint in the space domain thus far, arguably out of a shared understanding of the domain's fragility with respect to debris. The real question is how the military and commercial sectors can facilitate the "catch up" of diplomacy in establishing norms.

The second question was how IHL might apply to commercial space capabilities that are used to support military operations. It was pointed out that the application of IHL is difficult even in terrestrial matters. One could argue that a commercial satellite is a valid target in a conflict situation if it supports military operations. While it is very difficult to generalize definitively, one could easily construct an argument to support the view that such civilian assets could become legitimate targets given the activities in which they engage. Additionally, it must be kept in mind that IHL is judged by reasonableness. Even if such an argument were judged to be invalid later, if it was taken on reasonable grounds at the time, it would pass *jus in bello* conditions.

A participant asked if there were other legal regimes from which the realm of space security could draw lessons. Is the norms-based approach recommended for other difficult negotiations? One lesson learned from the nuclear regime is that even though legally binding instruments are preferable, they are extremely difficult to ratify in the United States.

Arguably, one should not press for a binding treaty that will never be ratified or enter into force. Conversely, though not officially ratified, the Comprehensive Nuclear-Test-Ban Treaty seems to have developed into a norm in the United States that constrains nuclear testing. In that sense, the absence of a treaty does not preclude norm-building and norm-building might be a more practical and successful way forward.

Another participant suggested that some national ambitions for space dominance were at odds with the pursuit of norms. Nevertheless, norms are inherently equitable. If a state is trying to establish dominance and norms at the same time, it will not work. Norms require that all states follow the same rules—equality of action even where there is inequality of capacity.

Lastly, it was pointed out that a consensus seemed to exist for taking further measures, but not on what those should be. The discussion suggested that one could move from norms to customary practice to binding arrangements. Though a legally binding treaty may be the ultimate goal, it is not currently possible to move directly to such negotiations. However, in looking at the historical record, it is typical in dynamic and difficult domains to gradually move from norm-building to codes of conduct to UN resolutions and, eventually, to a treaty. It is possible to imagine such a process, especially if the international community approaches each arrangement as an interim step, not a final position. It should be recognized that, at the very least, the international community has reached a consensus that the time for multilateral action in the realm of space security has come. The devil is in the details, but at least every state agrees it is in their best interest to pursue a multilateral solution.

#### **PANEL 4**

#### **THE VERIFICATION CHALLENGE—THE ART OF THE POSSIBLE**

The fourth panel began with a presentation on “The Basic Elements of a Successful Verification Regime” from Larry MacFaul, a Senior Researcher with the Verification, Research, Training and Information Center (VERTIC). He started with the basic definition of verification, which aims to gather, interpret and analyse information in order to make a judgment about a member’s compliance under a binding agreement. Verification is closely related to monitoring and in some cases they are almost the same. In some

ways verification could be interpreted more loosely. It is used throughout business, commerce and in both international and national contexts. It can be used for both binding and non-binding arrangements.

When talking about verification regimes, one should specify the type and purpose, Mr. MacFaul explained. The type of verification regime adopted will depend on the level of strictness desired. For example, hybrid models incorporate various levels of commitment and action. Is the regime meant to increase confidence that an agreement is being fully, fairly and effectively implemented? Is it intended to incentivize other states to join? In some cases, the type and purpose of the verification regime acts as a disincentive to membership. In most cases, verification mechanisms allow states to demonstrate good behaviour. They also help demonstrate that the treaty is heading towards its ultimate goal, whatever that might be. In some treaty areas, verification regimes serve a strong facilitative function. By checking for compliance, states also gather feedback on whatever is being verified.

Mr. MacFaul then listed the fundamental questions one should ask when designing a verification regime. First, what is being verified? Second, how reliably can it be verified now and in the future? And last, what are the costs associated with effective verification? By clarifying the scope of the treaty itself, actors can enable more fruitful discussions about verification. However, technical feasibility will impact both the scope of the treaty and its verification mechanisms. In many cases, states will purposely leave a treaty vague in order to foster agreement, but this will impede effective verification.

There are also different levels of verification. At the information-gathering level, verification could include self-monitoring, the establishment of a national agency to provide oversight of implementation, or reporting to an international body that processes data centrally. The next level requires verification of that gathered information and this can be conducted via inspections, data-checking or clarification mechanisms. All of these measures are meant to be reinforcing and are not mutually exclusive.

Mr. MacFaul added that for any treaty the key issues for verification are intrusiveness on a member state's sovereignty and the sensitivity of proprietary information. This is especially the case in arms control where confidential technical information is involved. Verification is also

complicated by discrimination, which must be avoided in two ways. First, the regime must be applied to all states irrespective of whether it is applicable to them. Second, in order to secure this comprehensive participation, states may need to pool resources equitably in order to ensure sufficient implementation.

According to Mr. MacFaul, three things are needed to build a successful verification regime in arms control: detection, deterrence and confidence-building. Such a regime need not be 100% effective to be successful. Rather, follow-up is critical. The treaty must have a way to deal with the information it does verify. The legal form taken can vary; such a regime could be constructed in or out of a formal body; it could be formulated before ratification of the main treaty or after.

The examples most relevant to a space verification regime would be the kind of permanent institutions associated with the nuclear regime, such as the International Atomic Energy Agency, and other arms control measures, such as the Organization for the Prohibition of Chemical Weapons. These long-standing, elaborate international mechanisms use a range of verification techniques, including self-reporting and inspections. While there are some tricky factors specific to space verification, many aspects have precedents in other areas. Data-sharing and dual-use technology issues are characteristic of other regimes, for example. The point is that not all verification activities are equally difficult. One can envisage a regime that incorporates multiple verification techniques for various levels of required compliance. The age-old problem of including everything or nothing is not the best way to proceed. Rather, this graduated or stratified structure is probably better suited to current space security challenges.

Dr. Laurence Nardon, Senior Research Fellow at l'Institut français des relations internationales (IFRI), presented on the topic of "TCBMs as Steps toward Verification". She pointed out that her presentation was sandwiched between two much more concrete presentations on what verification measures should be and which verification systems are currently, or may soon be, available. In order to complement these presentations, Dr. Nardon focused on the political context surrounding TCBMs and verification measures and, more precisely, on the relationship between the two. She noted that the title of her presentation reflected a widespread belief that TCBMs are a weaker version of verification measures; that TCBMs are agreed upon when verification is not possible;

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essentially, that TCBMs remain a “Plan B” solution. The title also presumes that progress would eventually be made towards the adoption of formal verification measures and that those would be an improvement on the previous TCBMs. Ultimately, the entire topic is a judgment about the order of measures that disarmament proponents should pursue. In her presentation, Dr. Nardon sought to question this underlying assumption.

She began by arguing that TCBMs and verification measures are inherently dissimilar. They are both information-gathering mechanisms set up between or among international actors that seek to better manage their relations, likely relations that are problematic or marked by mistrust. Fundamentally, both mechanisms are meant to reassure. In spite of these basic similarities, the two are not the same. TCBMs are non-binding and based on goodwill. They are cooperative measures (e.g. information exchanges, invitations to observe demonstrations, and the conducting of joint exercises). If one party decides to stop participating, there are no sanctions. This makes TCBMs very dependent on political context and the will of parties involved. Alternatively, verification measures are part of binding arrangements and are meant to be implemented by each party and, thus, are non-cooperative. Additionally, there are consequences involved with a failure to institute them. Another difference between the two is that verification measures are part of a larger treaty arrangement, while TCBMs typically constitute the entire arrangement unto themselves. Lastly, TCBMs are based on trust while verification measures are based on distrust.

In the 1970s TCBMs and verification measures were pursued in parallel and were linked to the larger political context. The Interim Agreement on the Limitation of Strategic Offensive Arms and the Anti-Ballistic Missile Treaty were the first legal instruments to include national technical means (NTM) of verification. These agreements also included a TCBM, the Standing Consultative Commission, which was established to act as an informal forum for discussion and data-exchange between the United States and the Soviet Union. Concurrently, TCBMs were officially discussed for the first time in the 1973 Helsinki process. They were formally adopted two years later. These original TCBMs aimed to reassure and diminish the threat of a surprise attack or misunderstanding of military activities.

At first, the verification measures and the Commission worked well, facilitating peaceful resolution of all major issues raised between the

United States and the Soviet Union in the 1970s. Unfortunately, when the Soviets invaded Afghanistan in 1979 the détente disintegrated. The Strategic Arms Limitation Treaty, signed in 1979, could not pass US Senate ratification. Both sides accused the other of cheating. The Standing Consultative Commission never met again. At the same time, the Helsinki process TCBMs were tested. For a few tense years in the early 1980s, the Commission on Security and Cooperation in Europe (established by the Helsinki process, now called the Organization for Security and Cooperation in Europe) was the only venue where the two superpowers discussed security matters. The lesson here is that TCBMs and verification were not sequential in the 1970s and early 1980s, they were parallel processes. Additionally, both came under stress when the political context went awry.

Dr. Nardon posited that a sequential approach to TCBMs and verification may actually be the best option for space security. She looked at how TCBMs present in the proposed Code of Conduct might pave the way for verification measures and a formal treaty later. Indeed, when the European Union began work on the Code in 2007, they operated based on the assumption that a formal treaty was currently impossible to negotiate. It was proving too difficult to agree on legal definitions of things like space weapons. Further, some states were strongly opposed to a binding instrument. As such, the Code format was considered a less controversial, more widely acceptable option. Therefore, the TCBMs enshrined in the Code represent a “Plan B” solution and the hope that more reliable verification measures and treaty provisions might follow over time. If this is indeed the EU perspective, then the Code of Conduct should be seen as an interim step towards a second OST. This might be a way to reconcile the EU proposal with the Chinese and Russian PPWT.

Dr. Nardon added that IFRI held a seminar two years prior to discuss space security. A strong debate emerged on whether a non-binding arrangement like the Code of Conduct would facilitate treaty negotiations, known as the “every little bit helps” approach, or whether it would dilute treaty efforts, the “exclusive” approach. Ultimately, all will depend on the dynamism of the international community on the issue of space security. The sequential approach may make more sense for space because it is not central to international politics and there are more actors involved. For these reasons, the impetus to take political action will be feeble and stretch over a long period of time. As a result, starting small may be the

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best near-term solution. One possible option would be to enhance and improve international, cooperative SSA. Shared SSA architecture is versatile and could serve both TCBM and verification purposes. National and non-governmental systems could be organized loosely to share data, which would in turn foster transparency and increase confidence. Conversely, the systems could remain strictly national and serve as the next iteration of NTM in a treaty for space. In conclusion, the development of SSA capabilities could certainly bring about a well-functioning code of conduct or binding treaty.

Dr. Dave Finkleman delivered the last presentation of the fourth panel on “Current and Potential Verification Capabilities”. He aimed to demonstrate that existing technology could enable sufficient verification of existing and potential space treaties. Dr. Finkleman began by emphasizing that no international agreement can be unequivocally verified. In fact, most multilateral agreements lack verification mechanisms altogether since many parties are unable to verify anything on their own and because the consequences of violation are so harsh that explicit verification is unnecessary. Given these realities, one must determine what level of verification is sufficient for the purpose at hand. In the case of space verification, Dr. Finkleman argued that almost all states are capable of contributing to achieve a sufficient level.

His approach conjectured some likely provisions of a space treaty and what non-compliance with such provisions would look like. He then identified what technical capabilities would be needed to perceive that non-compliance and act on it. He focused on civilian and commercial “Persistent Technical Means”, rather than government NTM. He then displayed a snapshot of a much larger table that surveyed all of the possible provisions, violations, observables and associated verification mechanisms. It showed a wide range of technical capabilities to monitor and verify varying levels of compliance and non-compliance.

In order to demonstrate some of these extant, technically feasible verification capabilities, Dr. Finkleman presented two representative analyses. The first was on a satellite manoeuvre in the southern hemisphere and the second on a manoeuvre of a geostationary satellite over the Indian Ocean. Both analyses showed that by combining existing Persistent Technical Means with US SSA data, orbital estimates for both of these manoeuvres achieved a much higher level of accuracy than the US system



alone. These two examples were especially telling because they looked at satellite manoeuvres over areas typically not covered by the US SSA architecture. Dr. Finkleman emphasized that this higher level of accuracy can be achieved with existing radars and telescopes located around the world. It just requires a bit of international cooperation and coordination.

Dr. Finkleman then switched to the topic of radio-frequency interference, another issue of international concern. He explained that roughly 50 relatively inexpensive reference emitters deployed around the world could effectively detect and locate such interference. He mentioned that Ukraine had already deployed a few of these emitters, even though it flies no satellites. This shows that a state need not be spacefaring to contribute to space verification mechanisms in a practical and affordable way. Another low-cost option is to include off-the-shelf monitoring capabilities, such as cameras, on satellite payloads. This can supplement existing capabilities in a modest way.

To conclude, Dr. Finkleman reiterated that treaty verification is a matter of degree. Parties to a treaty must decide on the sufficient level of verification needed to ensure regime efficacy. Civil and commercial means can contribute to verification needs and, in some cases, completely fulfil them. His presentation sought to demonstrate the existing capability of Persistent Technical Means to do so with a few concrete examples.

The question and answer portion of the panel began with a statement that the distinction between TCBMs and verification is not always so black and white, as Dr. Nardon's presentation suggested. In fact, there were collaborative and cooperative aspects to the earliest iterations of NTM. It was then asked if consultative mechanisms could play a role in the process towards a binding treaty. It was pointed out that there is already a consultative mechanism in the OST, but it requires consultations on the part of states about to engage in an act that might affect other actors. Recent experience exposes the problem of such wording because, in some cases, such an event will occur without any prior consultations. Perhaps a future agreement could incorporate retroactive consultations as part of its mechanisms. It was agreed that while these consultative mechanisms can serve a beneficial purpose, they need to be worded very carefully in order to be fully operational.

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A participant asked whether any existing verification regimes are able to successfully verify intent. It was recognized that intent is one of the most difficult aspects of verification, especially given the dual-use nature of many technologies and the possibility of accidents. Usually, it depends on whether technology exists that can prove attribution and malice. In addition, some regimes have incorporated complicated judicial processes for determining intent where evidence is gathered and presented. It really depends on how much time parties wish to devote to uncovering and proving intent.

Next, it was asked what measures could be used to verify that weapons are not placed in outer space, which is currently the only verifiable provision of the proposed PPWT. It was reiterated that nothing can be verified unequivocally. It is virtually impossible to determine if something is a space weapon until it is used. The only other way to verify this provision would be through invasive, on-site inspections of launches and payloads—and even that may be insufficient. Not all states would support such intrusiveness. It took decades for the United States and the Soviet Union to allow inspections of their nuclear facilities. Unfortunately, any robust arms control treaty will require effective verification and this is often only achieved through such intrusive measures.

## **PANEL 5 CROSS-INSTITUTIONAL COOPERATION— LINKING AND LEARNING**

Yvon Henri, Chief of the Space Services Department at the International Telecommunication Union, opened the fifth panel with his presentation on “The ITU’s Role in Promoting Space Security: Non-Interference as a Norm”. He began by stating that the ITU’s role is to regulate the radio-frequency spectrum. The Union was established by a binding international agreement, but still faces challenges in implementation and enforcement. Additionally, engineers authored the founding document, which further complicates its interpretation.

Commercial satellite operations began some 50 years ago and have since grown into a multibillion dollar industry. However, as the number of satellites in orbit has grown, so has the risk of radio-frequency interference. The ITU exists to manage the spectrum, assign orbital positions and

administer the registration database of active space assets. Once registered with the ITU, an actor is guaranteed certain rights, but is also obligated to abide by ITU regulations. For example, that party must coordinate with the ITU on present and future operations so that the ITU can help to ensure interference-free operations. In reality, interference is inevitable so the ITU focuses on ensuring an interference-controlled environment for space activities. The ITU governs all types of services and systems and tries to ensure that these services and systems can operate without the risk of harmful interference, which is defined as serious degradation of a signal to the point of obstruction or interruption that is caused by another operating, radio-communicating station. Since such interference knows no national borders, can be potentially dangerous and is very expensive, it requires an international solution.

Mr. Henri pointed out that while there may be enough physical space in key orbits, such as geosynchronous orbit, not all orbital slots are equally valuable. Every space actor wants a “prime slot”. As a result, these highly desirable positions have grown more crowded. To fully prevent interference, satellites would need to be separated by six degrees. However, with technological advancement and the increased demand for key orbital slots, satellites are now placed only 0.5 degrees apart and may cover the same areas and use the same frequencies, further increasing the risk of interference. Consequently, the ITU’s coordination of new satellite deployment is complex and requires advanced technical calculations. Political considerations may also impact the ITU’s coordination. For example, when deploying new satellites or systems from a developing state, any technical glitch could impede the success of that system, which would, in turn, have a relatively large, negative financial impact on the developing state. Furthermore, some states or parties may not bother coordinating their system with the ITU. As was seen in the case of Protostar-1, this can negatively impact those satellite systems in proximity and cost the owner-operator millions in avoidable expenses.

Mr. Henri discussed malicious interference next. Interference also occurs because of political, not technical, problems. In these instances, political solutions are needed. However, the perpetrator is still in violation of ITU regulations, which apply to all 192 member states. When malicious interference occurs, the affected party contacts the ITU, which in turn contacts the other parties involved and requests that action be taken to halt the interference. Unfortunately, the ITU must rely on the willingness

of parties to act. Mr. Henri emphasized the need to revise this process. Currently, if one actor refuses to abide by the ITU regime, it is up to the international community to respond to this bad behaviour. That is the only measure currently available for addressing non-compliance. The ITU must rely on its member states to strengthen the regime. It may be wise to discuss this issue at the World Radiocommunication Conference set to take place in 2012. However, it is a politically sensitive topic and will require the will of all parties to approve and abide by tougher regulations. Mr. Henri believes that the international community is ready to discuss the issue, though may not be ready to act on it.

Next, Dr. Dumitru-Dorin Prunariu, Current Chair of COPUOS, presented on “Space Sustainability: Setting a Technical Baseline for New Regimes”. He began by highlighting the importance of space sustainability, stating that it was a matter of concern for both spacefaring states and commercial satellite operators. If outer space is not safe, secure or peaceful, the ability to use it for national security purposes, Earth observation, telecommunications, financial transactions, navigation, scientific exploration and economic development would be hindered and even denied. The growing number of space actors, both governmental and private, the harmful effects of space weather, the proliferation of space debris and the development of private human spaceflight all call into question the ability to continue operating in a safe space environment. If the international community addresses space sustainability now, it could ensure humanity’s access to and use of space for the long term. In order to promote sustainable operations, all spacefaring parties must have access to complete, accurate and timely SSA. This requires international monitoring, communication and coordination.

Before looking at how the United Nations is pursuing space sustainability, Dr. Prunariu surveyed other existing initiatives in this area. First, the International Association for the Advancement of Space Safety (IAASS) is a non-profit organization dedicated to furthering international cooperation and scientific advancement in the field of space systems safety. Established in 2004 in the Netherlands, it became an observer to COPUOS in 2010. Its main principles are to ensure that citizens of all states are equally protected from missile overflight, launch vehicles and returning spacecraft; to ensure that any spacecraft—manned or unmanned—is developed, built and operated according to uniform, minimum safety standards that reflect the current status of knowledge and experience; to prevent the risk of

collision or interference during transit in airspace and on-orbit operations; and to ensure the protection of ground, air and on-orbit environments from chemical, radioactive and debris contamination. The Association uses a top-down approach, trying to create an international agency for setting policy, regulation and enforcement to which all commercial and government space entities would answer. Some may wonder if the Association's agenda overlaps with other international bodies such as the ITU, but COPUOS believes it can contribute to the discussion on the long-term sustainability of space activities regardless.

A second initiative addressing space sustainability is the satellite communications industry data exchange programme, the Space Data Association, an informal process launched by a group of satellite companies in November 2007. It aims to standardize orbital prediction models and reporting requirements to facilitate data exchange, as well as to develop a computer program for translating one data model into another so that companies can continue to use their existing systems. The Space Data Association has already developed a prototype for reporting data through a neutral third party, the Center for Space Standards and Innovation. The Center consolidates this data with official US government data to provide close approach and collision warnings. This system could be morphed into a global database and include other data. This process is informal, voluntary and self-regulating. Parties involved in this initiative are represented at COPUOS.

A third initiative that tackles space sustainability is the European Union's draft Code of Conduct for Outer Space Activities, which is meant to complement the extant space governance framework. The Code is one of the central proposals for a voluntary international agreement to enhance space security. It is, to some extent, designed to serve as an alternative to treaty proposals for PAROS, Dr. Prunariu suggested. Further, in his opinion, the draft Code is an effort on the part of the European Union to play a normative role in space security and to further develop the "principled" identity it hopes to portray. The draft Code of Conduct was deliberately constructed outside of traditional multilateral institutions like COPUOS and the CD and aims to strengthen the existing international framework for the management of space activities.

Moving on to UN efforts, Dr. Prunariu turned to COPUOS, which is composed of 70 member states and 29 permanent observers. It is the

premier international forum for discussing issues of space governance. Working groups in one of the two subcommittees—the Legal Subcommittee and the Scientific and Technical Subcommittee—will deliberate on matters first. Once they have reached a resolution on an issue, they present the matter to the full committee. After further discussion, COPUOS prepares a report, and possibly a resolution, for presentation to the General Assembly. COPUOS is currently debating the following topics: ways and means of maintaining outer space for peaceful purposes, implementation of recommendations from the Third UN Conference on the Exploration and Peaceful Uses of Outer Space, spin-off benefits of space technology, space and society, space and water, space and climate change, the use of space technology in the UN system, and international cooperation in promoting the use of space-derived geospatial data for sustainable development. The Scientific and Technical Subcommittee is currently debating topics such as space debris, space-system-based disaster management support, recent developments in global navigation satellite systems, the use of nuclear power sources in space, near-Earth objects, the International Space Weather Initiative, and an examination of the physical nature and technical attributes of geostationary orbit and its utilization and applications.

These topics demonstrate the range of problems associated with the utilization of outer space. As a logical development, a new agenda item was introduced in February 2010 and named “long-term sustainability of outer space activities”. The topic was introduced as a matter of concern not only for current and aspiring space actors, but also for the international community as a whole. Moreover, at its forty-seventh session, the Scientific and Technical Subcommittee recalled the importance of ensuring the safe and sustainable future use of outer space. The Subcommittee noted, in accordance with the work plan related to this item, that a working group should be established to support the preparation of a report on the long-term sustainability of outer space activities, the examination of measures that could enhance such sustainability and the preparation of a set of voluntary guidelines focused on practical measures that could be implemented in a timely manner to enhance sustainability. That Working Group conducted its first meeting in June 2010 and has held subsequent meetings. Thus far, the Group has established terms of reference, objectives and outputs, scope, method of work and a proposed multi-year work plan. The Working Group will examine a range of topics including: space utilization supporting sustainable development on Earth, space

debris, space weather, space operations, tools to support collaborative SSA, regulatory regimes and guidance for actors in the space arena.

Dr. Prunariu recognized that space sustainability is still a developing concept, but one that is of increasing interest to a wide variety of stakeholders. The term refers to a comprehensive and coordinated effort that should include developing tools of governance that lead to the reduction and removal of orbital debris, promoting international SSA to improve knowledge and transparency, and preventing intentional destruction of spacecraft by debris-causing ASATs. In his opinion, the best way to obtain stakeholder buy-in on norm-building or recommendations for the long-term sustainability of space activities is to use a “bottom up” approach. Dr. Prunariu is confident that it is easier to achieve those kinds of results in this manner than through negotiated treaties. Besides, such voluntary norms or recommendations could be translated step-by-step into formal, legal regimes. Regardless, it is clear that the long-term sustainability of outer space activities will represent an important debate in the coming years.

Annalisa Giannella, EU Director for Non-Proliferation and Disarmament, presented on “A Multilateral Code of Conduct as a First Step Toward Building Consensus”, which specifically examined the European Union’s proposed International Code of Conduct for Outer Space Activities. She began by emphasizing the danger posed by the growing risk of collision and debris in outer space. For the European Union, this danger stresses the importance of establishing rules of the road for space activities. In response, the European Union put together a proposal for a politically, not legally, binding instrument whose purpose is to ensure safety, security and predictability of space operations. Two underlying principles are found throughout the proposed Code of Conduct: the right of all to access space for peaceful uses and the right of all to self-defence, either individual or collective.

Ms. Giannella continued by describing the content of the current proposal. The Code of Conduct includes commitments to notify others about scheduled manoeuvres, launches, collisions or break-up, high-risk re-entries and malfunctions. It also includes more substantive commitments such as the promise to refrain from intentional harm to others’ assets or any activity that might lead to general harm. The Code also references other political and legal instruments, such as ITU regulations and the

OST. This is part of the Code's overall effort to strengthen the universality and implementation of the existing space regime. The draft also involves a cooperation mechanism, which can act as a first step towards further agreements. It enables states to consult with each other in the event of direct or indirect harm and allows for the possible establishment of formal incident investigating mechanisms in the future. In addition, the draft calls for biannual meetings where member states would review the functionality of and possible improvements to the Code.

Ms. Giannella mentioned that the proposed Code of Conduct would govern both civil and military space activities without distinction. This cross-cutting nature of the Code prevents it from being presented in either COPUOS, which addresses civil issues, or the CD, which addresses security issues. On that note, the Code of Conduct is not meant to be an alternative to the draft PPWT. In fact, the Code is both less and more ambitious than the PPWT. It is less so because it is a voluntary mechanism meant to enable mutual data-sharing and trust-building and takes no position on the PAROS debate. It is more ambitious because it covers both civil and military space activities.

In conclusion, Ms. Giannella emphasized that the promoters of the Code are not against the CD negotiating a legally binding treaty. The Code is not meant to address those arms control issues. That is why it has been presented in an ad hoc way. She mentioned that the European Union is willing to present the Code to the GGE. However, she stipulated that the European Union does not consider the GGE an appropriate forum for negotiating the Code since it was established to discuss TCBMs as part of the larger PAROS debate, which is not in the Code's purview. For these reasons, the Code should be discussed in a separate forum. The European Union has already consulted with a number of states on the draft and continues to be open to suggestions. The current draft is a preliminary and modifiable version. As a next step in the process, the European Union intends to convene a multilateral experts meeting in 2012.

A participant asked if there were any way to strengthen ITU regulations. For example, in the event of non-compliance, could the ITU take away the violating party's rights? Many states have agreed on the need to strengthen the ITU's enforcement mechanisms. However, it is a consensus-based organization and will likely face resistance in trying to establish tougher mechanisms. Another participant pointed out that because the ITU lacks



monitoring, verification and enforcement mechanisms, it is really no more than a code of conduct. In response, another participant explained that the ITU's monitoring capacity is growing, but it is very difficult to prove attribution when non-compliance occurs, even if monitoring shows from where the non-compliance is coming. However, in many cases, treaty non-compliance is solved via political means regardless of whether or not the treaty has formal enforcement mechanisms. The beauty of a well-designed treaty, though, is that states have a "Plan B" when political solutions cannot be found.

Another participant pointed out that the "bottom-up approach" endorsed by Dr. Prunariu could take decades. In the case of an urgent need, such as for space traffic management, this process may take too long. Has COPUOS considered pursuing a top-down approach for urgent issues? Space traffic management itself is not specifically mentioned on the COPUOS agenda, but long-term space sustainability is a broad enough framework that it could include such an issue. It does take years to solve problems within COPUOS, especially since the main input to the body is political. Several states must agree on the need to discuss an issue before it gets placed on the agenda. Even in cases where there is agreement, last-minute problems can interfere with finding a solution. It is not clear how something like space traffic management could get on the COPUOS agenda in the immediate future, but if a related crisis were to occur, it could prioritize the issue as was seen with space debris.

One participant pointed out that the Code of Conduct is superior to TCBMs because it takes TCBMs and embeds them in norms. Some had pointed to the commonalities between the Code of Conduct and the GGE's objectives. If the Code of Conduct were discussed within the GGE, it might provide further impetus to norm-building. However, if the Code were to become part of the GGE mandate, it would become wrapped up in the PAROS debate. The European Union feels this would delay progress on the Code of Conduct, which EU officials see as an urgent issue. This is why the European Union chose a less formal, less ambitious approach.

Another question was posed on jurisdictional tension between COPUOS and the CD. The mandate of both bodies is clearly delineated. While some matters overlap, COPUOS is not meant to discuss security issues and certain member states ensure that this remains the case.

Some questions specific to the Code of Conduct were raised, seeking clarification on its call for a central point of contact, its assurance of the right to self-defence and its consultation mechanisms. Section 11 of the Code calls for the nomination of a central point of contact. Typically, such nominations are followed by an official appointment, election or approval process. How would this be carried out and would the point of contact be permanent? This is not yet defined and the European Union is open to discussing this issue further with interested states. Perhaps this point of contact could be linked somehow to the UN Secretariat. In article 4, paragraph 2, the Code of Conduct states when and how the right to self-defence is activated. On the Code's consultation mechanism, if an impacted state calls for a consultation, who assesses the allegations and makes a judgment that it is actually needed? Since the Code does not establish a supranational body to make such judgments, the trigger for consultations must come from a subscribing state. However, the other state must also be a subscriber and willing to engage in consultations. That is why the consultation mechanism is a TCBM because, by signing the Code, a state agrees to be open to bilateral consultations. No third party would reach a decision based on those meetings, they are purely meant to foster communication.

## **PANEL 6**

### **ENGAGING CRITICAL ACTORS**

John Sheldon, Assistant Professor of Space and Cyber Strategic Studies at the US Air Force School of Advanced Air and Space Studies, began the panel with a presentation on "Reducing Military Tensions, Building Trust", which looked at how military-to-military relationships might reduce tensions and build trust on issues of space security. He emphasized that his remarks were strictly representative of his own personal opinion and not of his employer, the US Air Force. In his current position, he teaches military students from all over the world.

Dr. Sheldon first emphasized that politics are the central factor. Without political sanction, military-to-military relations are impossible. In order for these relationships to form, there must be leadership and goodwill on the part of the political authorities on both sides, which is not always the case. Unfortunately, as with arms control issues, the cases where military-to-military relations are most needed are often the cases where they are

most impossible, due to this lack of political endorsement. Dr. Sheldon also warned that expectations management is crucial when approaching military-to-military relations. They will never be a panacea, but with enough time and commitment they could help develop informal back channels and mitigate tension when communication is needed. In many ways, military-to-military connections are easier than arms control because they are informal and a good starting point for building trust and reducing tensions in interstate relations.

With these forewarnings in mind, there are benefits to establishing military-to-military relations. They can engender professional respect between the military officers of two states, especially when this interstate relationship has been previously characterized by mutual mistrust and suspicion. Dr. Sheldon highlighted that this can be incredibly important as it humanizes the other side and exposes each side to the other's culture and values. This benefit can and has been overplayed. While military-to-military connections can expose one side to the other, it does not necessarily mean that either will adopt the other's approach; it simply means they learn to understand each other. Over time, this leads to the development of informal back channels and mutual trust. Additionally, these relationships can prove useful much later. When these officers have risen in rank, they may be able to have discussions with their counterparts in other states based on these historical relationships and entrenched trust. For example, the United States often appoints retired generals as envoys because they have extant relationships with foreign counterparts. Military-to-military relations can also help each side understand the other's doctrine, capabilities and intentions, Dr. Sheldon stated. This is less about "peeking behind the green door" and learning military secrets, and more about mitigating the worst hyperbolic assumptions about the other side through simple exposure. In this way, military-to-military relations help differentiate between fanciful thinking and pragmatic policy.

One challenge of military-to-military relations is that they are often seen and treated as a reward for good behaviour in interstate affairs. Conversely, much like diplomatic links, military-to-military relations should be a part of an overall communication strategy between and among states. Dr. Sheldon added that another challenge of military-to-military relations is that many are impatient to see the payoffs of such connections right away. Unfortunately, the benefits take time to materialize, often over the course of a generation. A third challenge is that a visiting officer through

a military exchange programme may have unreasonable expectations about the information he should have access to. Engaging in military-to-military relations does not grant a party access to the other party's confidential information. Lastly, cultural and political misunderstandings or misperceptions can be a challenge to military-to-military relations.

In spite of these challenges, military-to-military relationships can be beneficial. Successful ones will be characterized by constant communication, patience, commitment and political and cultural awareness of the other side. Realistic expectations are also critical. Each side must understand that military-to-military relations will not solve all underlying political problems, but they can contribute to increased trust and stability in the long term.

Dr. Sheldon concluded by stating that, where the political context allows, military-to-military relations should be established among key players in relevant space communities. This should include exchanges at military academic institutions, regular meetings and discussions at the senior officer level and, when appropriate, technical committees on issues of mutual concern. Such relations already exist in some cases including SSA and data exchanges, hotline communications between senior commanders in the event of crisis, exposure to each other's doctrines and culture, and visits to facilities and conferences. Hopefully, these connections will lead to mutual respect and trust and enable a certain amount of transparency and educated insight into each other's intentions. This can help support the development of international TCBMs, and perhaps other initiatives over time.

Victoria Samson, Washington Office Director for Secure World Foundation, presented on the topic of "Industry Inputs: From TCBMs to Verification". She began by highlighting the importance of the commercial sector in space. Satellite communications are usually provided by international companies. In fact, about 75% of the US Department of Defense's satellite bandwidth is purchased from international consortia. Given the international nature of satellite operators and their growing role in government operations, they will likely need to be involved in deciding norms of responsible behaviour in space. Ms. Samson emphasized the importance of SSA. The number and types of actors participating in space activities is rising, making the space environment even more crowded. Sharing SSA data is one basic area where international cooperation should

be enhanced. This need is currently met through SpaceTrack.org, an initiative of the US military. While this database is useful, the information it provides is relatively limited since private companies often know more about the location of their space assets.

Additionally, commercial satellite operators regularly exchange data about the activities of their satellites. This information includes plans for upcoming manoeuvres, location of their space assets and, in case anything goes wrong, contact information. Commercial satellite owners and operators have provided the international community with a shining example of how to go about establishing and conducting responsible behaviour in space. This system has arisen out of a pragmatic calculation of best interests, not out of private sector altruism. Everyone benefits from ensuring safe operations and manoeuvres, non-interference and the avoidance of collisions. Moreover, this system was established outside of any government regulations, instead using norms of behaviour that have emerged through years of experience. In order to formalize, improve and ramp up tracking and data-sharing activities, three major satellite companies have jointly established a private sector solution called the Space Data Association, which aims to standardize and compile in a uniform and confidential format the much more precise information about space objects known by operators and merge this information database with the information already gathered and maintained by the US military. The ultimate goal is not to replace the US efforts, but rather to augment them in the hope of building a comprehensive and accurate database that can reduce or eliminate the threat of radio-frequency interference and potential collisions. Many commercial actors were outsourcing or internalizing this tracking functionality; the Space Data Association eliminates these redundancies in a cost-effective manner.

Ms. Samson discussed how Intelsat's Galaxy-15 offers another lesson of the benefits of cooperating with industry. The satellite was launched last year, but stopped responding to commands even though it continued to broadcast. It was drifting across various orbits because Intelsat's operators could not control its manoeuvres. Intelsat knew exactly where the satellite was, but its uncontrolled movements meant that the US military's tracking system could not keep up with it. In fact, 15% of the US information about the position of Galaxy-15 was inaccurate. This highlights the need for SSA sharing—whether among commercial and military satellite operators, or among states. Also, it demonstrates the need to establish norms and

procedures for cooperating on space data sharing in order to make sure that there is a global solution available for emergency situations. Further, sharing data will increase accuracy, leverage existing systems, prevent reliance on single sources of data and broaden the adoption of best practices.

Ms. Samson explained how the Galaxy-15 case impacts the discussion about norms of responsible behaviour in space. Some contend that Intelsat set a norm for responsible space behaviour, thanks to its extensive communication, coordination and mitigation efforts with other satellite operators while Galaxy-15 was unresponsive to commands from the ground. Ms. Samson questioned if the international community is content to let Intelsat establish the precedent for dealing with uncontrolled satellites. This is another argument for why states should actively pursue and participate in the creation of norms for responsible space behaviour.

Ms. Samson emphasized the potential for space to be a realm of international outreach and cooperation. However, current US export control regulations hinder American industry from interacting and collaborating with international partners. Reforming export control could allow for increased cooperation with select partners, thereby enhancing ties between the United States and its allies and laying the groundwork for cooperation on more difficult national security issues. While many see the need for export control reforms, it is an extremely sensitive issue in US domestic politics. The Obama administration has been supportive of reform, probably because it helps with jobs and shores up the US industrial base, but also because it could serve as a diplomatic tool for reaching out to states that the United States needs to be on good terms with. Several steps have been made towards executing reform and if successful it would definitely bolster the United States' ability to pursue international cooperation in space.

Ms. Samson concluded by reviewing the possible benefits of working with industry on verification issues. Since such a large share of satellite operations are provided by commercial actors, any decision to commence with TCBMs or verification efforts would need the satellite operators' cooperation in order to succeed. Overall, it is very easy to call for international cooperation, but it will take real and difficult steps to enhance it in space. It is important to remember that, given how much the line has blurred between commercial and governmental space assets

and usage, this cooperation has to occur with industry as well. Moreover, in considering international norms of behaviour, one should keep in mind those that have already emerged in the commercial satellite industry.

Beatrice Fihn, Project Associate at Reaching Critical Will, presented on “The Role of Civil Society in Building Awareness” and provided an overview of the roles civil society and non-governmental organizations (NGOs) can play in promoting and enhancing space security. She began by explaining that states remain the principal actors in the security arena. While NGOs and civil society have penetrated other international issue areas (such as human rights and the environment) rather successfully, they remain relatively uninvolved in disarmament and security initiatives. The importance of national security in these issues has made formal involvement more difficult, even though NGOs have a potentially significant role to play in fostering understanding, political will, awareness and a better environment in which to discuss security issues. Ms. Fihn provided an overview of the types of groups and actors that compose civil society. Some well-known examples include academics, scientists, activists, consumers and consumer organizations, foundations, trade unions, policy institutions and the corporate sector. This diverse group of players represents an equally diverse range of interests. Each NGO has its own objective and can receive funding from varied sources that also have their own agendas. With that said, it is widely recognized among states that NGOs are increasingly important. Ms. Fihn pointed out that the relationship between government and civil society is strengthening, even in traditionally state-centric realms such as the military and national security. More broadly, civil society has developed and changed over the past 50 years. NGOs have taken on more issues, multiplied, expanded and increased their role in official government and international organizational operations.

Ms. Fihn reviewed the ways that civil society can contribute to promoting space security. First, it can generate public awareness. Civil society has often been able to place a topic on the international agenda and demand action from governments through public awareness campaigns at the national, the regional and the global level. This, in turn, helps generate political will for an issue. Civil society has successfully achieved this for other security concerns including disarmament, nuclear weapons, landmines and cluster munitions. For space, civil society can help inform the public of the critical importance of space assets and of humanity’s dependence on them.

Second, civil society can also contribute to space security by reframing issues. Historically, NGOs and civil society have managed to reframe conventional military and security issues in a humanitarian light. In space, civil society could actively reframe the benefits of space by highlighting the human and environmental security implications of a domain typically seen as facilitating military and national security activities.

Third, civil society could develop norms of responsible state behaviour. NGOs have actively reshaped norms of responsible behaviour for the use of landmines and cluster munitions and are currently developing codes of conduct for biotechnology. Civil society can support the formulation of similar codes of conduct for space activities.

Fourth, NGOs and civil society can actively lobby and advocate, which has been one of its most traditional roles at both the national and the international level. NGOs may lack a significant formal role in multilateral security frameworks, but they can actively lobby diplomats on these issues. A few examples given by Ms. Fihn include the regular presence of Greenpeace in CD negotiations on the Comprehensive Test Ban Treaty and Oxfam and Amnesty International activists effectively lobbying for a General Assembly resolution on an Arms Trade Treaty in 2006. NGOs should actively advocate for space security objectives in important fora such as COPUOS and the CD.

A fifth contribution that civil society could make is by providing research and expert advice on space security issues. Expertise provided by think tanks, academia and research institutions is increasingly important to policymaking. Civil society often advises governments on technical issues, new areas of research and policy impacts. Since space is a highly technical subject area, experts from NGOs and civil society could play an important role in equipping decision-makers with the knowledge necessary to understand space issues on the negotiating table.

Sixth, NGOs can monitor and evaluate the behaviour of states and other actors. Civil society can assist in creating and implementing assessment tools for monitoring state compliance with international commitments. For example, the *Landmine Monitor*, a civil society product, has become the de facto monitoring regime for the Mine Ban Treaty. Additionally, Reaching Critical Will monitors and reports on UN disarmament negotiations, enabling others to follow these issues. One example of this in the space



security realm is the annual *Space Security Index*, a comprehensive study of current issues, background information and in-depth analysis.

Seventh, civil society and NGOs can contribute by being an interlocutor or facilitator. They can provide neutral meeting space for space security discussions and “off the record” meetings. UNIDIR and Secure World Foundation have been active in this type of role.

Eighth, civil society can actually help implement policy. For example, Mine Action is an example of an NGO actively helping to implement the Mine Ban Treaty through demining and victim assistance programmes. At this point, there is no space security agreement to help implement, but in the future technical and commercial experts can help design implementation procedures.

A ninth possible contribution from civil society could be as entrepreneurs. Often, NGOs seek to fill in the gaps left by government and international policy. The Small Arms Survey is a good example of this entrepreneurial role played by civil society actors. The Survey was created because there was no global body equipped to specialize in small arms issues even though the topic was growing increasingly important. In addition, Reaching Critical Will recognized the lack of transparency in UN disarmament negotiations and sought to increase the availability of related information. The official forum for negotiating space security issues is currently deadlocked so civil society can step in and provide venues for cross-institutional conversations.

Lastly, civil society can contribute by providing a global perspective on traditionally national interests. NGOs often find ways to form transnational networks and combine their efforts with other international civil society actors. On space security issues, NGOs can promote a global commons perspective of space.

Ms. Fihn mentioned the limits of civil society, which include a Western bias and sometimes opaque agendas. International civil society is largely dominated by Western NGOs and is, therefore, not as representative of the global community as one might hope. Additionally, Ms. Fihn reemphasized the diversity of interests represented by NGOs and civil society actors. Issues of transparency and accountability are equally important in civil society. It is not always clear where funding comes from and whose interests these groups represent. Despite these limits, civil society can

and does play an important role in the international community. In outer space, the range of threats and challenges has grown and changed over the years. In order to fully tackle them, states should involve a wide range of actors, including NGOs and civil society. They can play a crucial role in building understanding, awareness and political will.

The question and answer session began with a participant positing the possibility of micro-loans to developing states that were interested in becoming involved in space. These states could then provide data over minimally covered areas in the southern hemisphere. This was considered a good idea, especially because space can provide human and environmental security benefits to these developing countries. Additionally, COPUOS already engages in capacity-building for developing states. It is one of COPUOS' main goals and NGOs, including Secure World Foundation, help to achieve it.

Another participant pointed out that because many states, including developing states, are joining the space community, this highlights the need for norms of responsible behaviour. Actions by any space actor can harm all others. These actions need not be intentional or hostile; they could be accidents. Capacity-building should also focus on educating these new space actors about responsible space behaviour.

A participant raised the issue of multiple sectors within a government needing to cooperate and coordinate policymaking for space issues. They felt that civil society could also play an important role in building awareness and facilitating cooperation among agencies within a state. Unfortunately, raising awareness can be difficult and sometimes a crisis or dramatic event is needed to motivate interagency or international cooperation and coordination.

The issue of industry and private sector self-regulation came up next. If industry is allowed to completely self-regulate, there would be no export control and space might be even more crowded. However, government and international legal approaches can take decades. Could a balance be found between the two? In some cases, industry initiatives demonstrate interesting possibilities. And in the event that profit-driven industry initiatives threaten space sustainability, political leadership could step in to ensure that efforts are guided towards the long-term use of space.

## CLOSING REMARKS

Ben Baseley-Walker, Advisor on Security Policy and International Law for Secure World Foundation, concluded the conference by emphasizing that timing is crucial. Extensive diplomatic discussion of PAROS in formal multilateral settings is easy to undertake in principal, he said, but the activities and initiatives of industry and other relevant space actors demonstrate that if the CD waits too long to take action, it will be too late to influence the outcome. He added that the past two days of the conference had been productive and showed a definite shift in tone towards progress compared to previous years. The international community has clearly prioritized space security issues and the US delegation has rejoined CD discussions, both demonstrating a renewed negotiation climate based on a shared understanding of common goals.

Mr. Baseley-Walker highlighted that the conference placed an emphasis on building foundations together. A lack of shared understanding of the foundations that underpin space security discussions has hindered previous efforts to move forward. This conference showed that the CD is much closer than ever before to reaching a mutual understanding of fundamental concepts. A Code of Conduct or TCBMs will be key steps for moving forward, Mr. Baseley-Walker stated, and though they may not lead to binding treaties, these panel discussions have shown that the CD has a clearer understanding of what the path forward may be from both a diplomatic and political perspective.

## ABBREVIATIONS

ASAT	anti-satellite, anti-satellite weapon
CD	Conference on Disarmament
COPUOS	Committee on the Peaceful Uses of Outer Space
GGE	Group of Governmental Experts
IADC	Inter-Agency Space Debris Coordination Committee
IFRI	Institut français des relations internationales
IHL	international humanitarian law
ISO	International Organization for Standardization
ITU	International Telecommunication Union
NASA	US National Aeronautics and Space Administration
NGO	non-governmental organization
NTM	national technical means
OST	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies
PAROS	prevention of an arms race in outer space
PPWT	draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects
SSA	space situational awareness
TCBM	transparency- and confidence-building measure

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UNIDIR

“Space Security 2011: Building on the Past, Stepping towards the Future” is the tenth annual conference 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. This conference focused on current and emerging threats in the space domain and the ongoing efforts to address them, the technical aspects of ensuring space security and enabling regimes supporting that end, the necessity and benefits of cooperation among the many actors now involved in space and space-related issues, and identifying and engaging those actors that will be necessary to the success of regimes set up to protect and encourage the long-term safety and accessibility of space.